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February 15, 1975

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Volume 31, Number 3, February 15, 1975

NUCLEAR SCIENCE ABSTRACTS

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CARTER, G., See REED, D.J., 30:21824
CASA, A.F., Nuclear energy in Japan, 30:23243
CASARETT, A.P., See KALLFELZ, F.A., 30:21411
CASCI, C., Method for preliminary analysis of MHD generator performance, 30:20916 (AGARD-CP-104)

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Optimization of control-rod programming in multiregion nuclear reactors, 30:23184
REACTOR COOLING SYSTEMS/TRANSIENTS
WFLASH: a FORTRAN-IV computer program for simulation of transients in a multi-loop PWR, 30:23171 (WCAP-8261(Rev.1))
REACTOR CORES/INSPECTION
Initial results of a holographic tomosynthesis technique for fuel-core inspection, 30:23198
REACTOR CORES/STRESS ANALYSIS
Methods of stress analysis in use at General Atomic for core design (HTGR graphite moderator), 30:23078 (GA-A-12870)

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23214 (HEDL-TME-74-16) ANALYSIS OF TEMPERATURE PROFILES IN TRANSIENTLY HEATED UO_2 USING MOLYBDENUM INCLUSIONS. Wilmot, E. L. **(Hanford Engineering Development Lab., Richland, Wash. (USA)).** [nd]. Contract AT(45-1)-2170. 23p. AT.

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HEDL quarterly technical report, January--March 1974. Volume I. Materials technology, 30:21815 (HEDL-TME-74-1(Vol.1))
Modeling of the post-irradiation fuel-cladding gap in mixed-oxide fuels, 30:23103 (HEDL-TME-74-19)
Preliminary data report: post-irradiation examination of fuel pins PNL-10-23 and PNL-10-63, 30:23149 (HEDL-TME-74-23)
Prototype applications loop two years of operation, 30:20928 (HEDL-TME-74-24)

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NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Analytical and Separations Chemistry

5542 PROBLEMS OF SYSTEMATIC ERRORS IN THE TRACE ANALYSIS OF ELEMENTS. Toelg, G. (Max-Planck-Institut fuer Metallforschung, Schwaebisch Gmuend (F. R. Germany). Inst. fuer Reinststoffe). Vom Wasser; 40: 181-206(1973). (In German). 15 figs.; 7 tabs.; 18 refs.

Problems of the trace analysis of elements are discussed in connection with the optimization of the biological cleansing of sewage. At the core of the discussion is the limitation of the detection of very low concentrations of elements through systematic errors during decomposition of the samples and during the enrichment of the traces of the elements to be determined. Causes of these errors (effects of adsorption, volatilizations, blank values etc.) are indicated, and possibilities of their reduction are described by means of selected examples. (auth)

Activation and Nuclear Reaction Procedures

Refer also to abstracts 5598, 5997, and 6762.

5543 (AD-781341) CENTER FOR EXCELLENCE IN CERAMIC MATERIALS. Interim Report, 1 September 1967-31 August 1968. McGee, T. D. (Iowa State Univ. of Science and Technology, Ames (USA). Engineering Research Inst.). Aug 1968. Contract F33615-68-C-1034. 55p. (ERI-314). NTIS $5.75.

Research in the following areas is discussed: solid electrolytes; acoustoelectric coupling; ferroelectrics; mass transport in oxides; mechanisms of creep; activation analysis; and glass adsorption isotherms. (GRA)

5544 (IRI-133-73-16) VANADIUM CONTENT IN MEADOW GRASS AROUND ARNHEM. de Goeij, J. J. M.; Bode, P.; Zegers, C. (Interuniversitair Reactor Instituut, Delft (Netherlands)). [nd]. 18p. (In Dutch). Dep. NTIS (US Sales Only) $4.00.

Neutron-activation analysis was used to determine the V, Al, Cl, Mg, Mn, and Tl content of grass in the vicinity of Arnhem. Samples were taken in May, June, July, August, and October 1972. The results are tabulated for various sampling sites. (JSR)

5545 (NIM-1563) NEUTRON ACTIVATION ANALYSIS OF SAMPLES FROM THE KIMBERLEY REEF CONGLOMERATE. Rasmussen, S. E. (National Inst. for Metallurgy, Johannesburg (South Africa)). 1 Oct 1973. 254p. Dep. NTIS (US Sales Only) $15.75.

Thesis.

The technique of instrumental neutron activation analysis as applied to the analysis of geological material has been studied with particular emphasis on methods of reducing or eliminating analytical errors. The neutron flux gradients in the reactor irradiation facilities used were found to introduce errors of up to 20%. The use of iron foils to monitor both the thermal and fast neutron flux received by individual samples has been shown to reduce irradiation errors to approximately 1%. The contribution of epithermal neutron resonances to (n,γ) reaction cross sections has been recognized. Estimated epithermal neutron flux factors have been shown to reduce the associated errors by as much as 7%. Methods of optimizing experimental parameters for the use of I.N.A.A. as a multi-element analytical technique are presented. In particular, decay times have been optimized for minimum error in the determination of peak areas. An analysis has shown that the errors due to counting statistics are in general equal to all other errors combined. The accuracy of the methods developed has been estimated from the analysis of standard reference materials. The analysis of four U.S.G.S. multi-element rock standards for 23 elements has shown that an accuracy of 6% can be expected for determinations at the 10 parts per million level. The analytical technique developed has been applied to a problem of interest to the gold mining industry in South Africa, namely the identification of sedimentary strata within a known succession. At present the strata are distinguished using qualitative methods based on known mineralogical differences between strata. A quantitative method based on trace element patterns has been investigated and found to be successful. A series of conglomerate and quartzite samples from the Kimberley Reef Conglomerates at the Durban Roodepoort Deep Mine have been analyzed by I.N.A.A. and up to 28 trace and minor elements determined. Multivariate statistical techniques have been used to determine trace element patterns, characteristic of each stratum. Six strata have been investigated and 100% accuracy of separation achieved using homogeneous powdered samples. It has been shown that whole rock conglomerate chip samples can be classified with 87% confidence and quartzite chip samples with 100% confidence. (auth)

5546 (NIM-1639) DETERMINATION, BY 14 MeV NEUTRON-ACTIVATION ANALYSIS, OF SMALL AMOUNTS OF OXYGEN AND SILICON IN DIAMOND. Bibby, D. M. (National Inst. for Metallurgy, Johannesburg (South Africa)). 13 Sep 1974. 14p. Dep. NTIS (US Sales Only) $4.00.

Techniques for the measurement of low levels of oxygen and silicon by fast-neutron activation analysis have been developed and applied to high-quality diamonds. For oxygen, limits of detection of approximately 5 μg have been established. Sources of error have been studied and eliminated, the ubiquitous occurrence of oxygen being the major problem. Within the accuracy of this work, the results obtained show no significant differences between the oxygen contents of diamonds of different types, or of diamonds from different sources. An oxygen content of 35 ± 4 ppM has been established for high-quality, colorless diamonds. For silicon, a limit of detection of 25 μg was established, and the average silicon content of high-purity diamonds was found to be less than 3 ppM. It is concluded that the oxygen in high-purity diamonds is present as CO_2 or H_2O and not in silicate inclusions. (auth)

5547 APPLICABILITY OF PHENOLFORMALDEHYDE RESIN AS AN INERT MATRIX FOR COMPARISON STANDARDS IN ACTIVATION ANALYSIS. Kolomiitsev, M. A.; Ambardanishvili, T. S.; Dundua, V. Yu.; Zakharina, T. Ya.; Gromova, G. M.; Pachuliya, N. V. Sov. At. Energy (Engl. Transl.); 35: No. 5, 1031-1032(Nov 1973).

Translated from At. Energ. (USSR); 35: No. 5, 348-349(Nov 1973). This is a summary of paper No. 704/7110.

Construction of comparison standards for neutron activation analysis which can be used to make a direct measurement of activity and to record γ-spectra after irradiation by high integral neutron fluxes of up to 10^{19} n/cm^2 is a problem of current interest. The present work shows that the synthesis of phenolformaldehyde bakelite resin under the special conditions in which contact of the monomers and catalyst (ammonia) with the glass is excluded gives a polymer with a low content of neutron-sensitive impurities which are activated under the action of neutrons to form γ-emitting isotopes. (LK)

5548 NEUTRON ACTIVATION ANALYSIS OF DINOSAUR BONES FOR URANIUM, THORIUM, AND RARE EARTH ELEMENTS. Ganzorig, Zh.; Gun-Aazhav, T.; Gerbish, Sh.; Otgonsuren, O.; Sereeter, Zh.; Chadraabal, L.; Chultem, D. Sov. At. Energy (Engl. Transl.); 35: No. 5, 1033-1036(Nov 1973).

Translated from At. Energ. (USSR); 35: No. 5, 349-351(Nov 1973).

Uranium and thorium contents of dinosaur bones were determined nondestructively with resonance neutrons. For analysis for rare earth and other elements, the bone sample was irradiated on the thermal channel of the IBR-30 reactor with a flux of 1.3×10^{13} n/cm^2·sec for 5 minutes. The analysis for U and Th was quantitative, but for the rare earths it was only qualitative. (LK)

5549 USE OF STABLE TRACERS IN CHELATE COMPOUNDS AND OF NEUTRON ACTIVATION FOR INVESTIGATION OF WATER FILTRATION IN MINES. Jureczko, J. (Central Mining Inst., Katowice, Poland); Dulewski, J.; Zmij, M.; Adamski, L.; Jozefowicz, K. Nukleonika; 19: No. 9, 823-834 (1974).

A stable tracer method and neutron activation analysis for examination of water filtration in coal mines is described. The chromium ion combined in a chelate complex with EDTA was used as tracer. A special preparation of samples increased considerably the degree of tracer detectability. The sensitivity attained was 2.5×10^{-10} g/ml. The first part of the paper covers the survey of tracer methods used for investigation of water filtration; the other parts cover methods for preparation of the chelate tracer, preparation of samples of water containing the tracer, activation of samples in the reactor and spectrometric measurements. On the basis of tests carried out the ways of flow of washery waters delivered to workings left after the extraction of coal were determined. In addition the percentage of the delivered water which remains in the rock strata was determined. (auth)

5550 IN VIVO ACTIVATION ANALYSIS FOLLOWING NEUTRON THERAPY IN CANCER PATIENTS. Bond, C. D. (Naval Research Lab., Washington, DC); Theus, R. B.; August, L. S.; Shapiro, P.; Rogers, C. C.; Costa, G. Trans. Amer. Nucl. Soc.; 19: 52(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5551 INVESTIGATION OF THE RELATIONSHIP OF HAIR ZINC LEVELS TO LEARNING PROBLEMS. Dondan, T. J.; Prasad, K. N.; Jester, W. A. (Pennsylvania State Univ., University Park). Trans. Amer. Nucl. Soc.; 19: 56-57(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5552 ISOTOPICALLY LABELED WATER USED TO MEASURE ENERGY AND MATERIAL BALANCE IN ANIMALS. Nagy, K. A. (Univ. of California, Los Angeles). Trans. Amer. Nucl. Soc.; 19: 71-72(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5553 EFFECTS OF COUNTING TIME AND MOISTURE VARIATION ON NEUTRON-CAPTURE GAMMA-RAY ANALYSIS OF ORE SAMPLES. Sandquist, G. M. (Univ. of Utah, Salt Lake City); Akalin, O.; Rogers, V. C.; Byrne, J. M. Trans. Amer. Nucl. Soc.; 19: 77-78(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5554 NONDESTRUCTIVE MEASUREMENT OF HELIUM CONCENTRATION IN METAL FOILS. Pieper, A. G.; August, L. S.; Smidt, F. A. Jr. (Naval Research Lab., Washington, DC). Trans. Amer. Nucl. Soc.; 19: 125-126(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5555 COMPARATIVE MULTIELEMENT ANALYSES OF AIRBORNE PARTICULATE SAMPLES COLLECTED IN VARIOUS AREAS. Mamuro, T.; Matsuda, Y.; Mizohata, A. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 11-18(1973).

In order to grasp the characteristic features of air pollution by particulates in various areas in Japan, multielement analyses by instrumental neutron activation analysis and radioisotope energy dispersive x-ray fluorescence analysis were applied to 31 airborne particulate samples collected in 15 different areas, and the analytical results obtained were compared with one another. All the samples were collected by so-called "10 micron cut" samplers, the collection efficiency of which is considered to be 50% at 8μ and nearly zero beyond 10μ. Among the areas in question there are clean seaside areas, heavily industrialized areas, small cities along the Inland Sea or the Pacific Ocean around which industrialization is progressing, a small city having only a big iron work, an area famous for its ceramic industry and so on. The atmospheres over them were found to be quite different not only in pollution extent but also in pollution pattern. (auth)

5556 ACTIVATION ANALYSIS OF PARTICULATES EMITTED FROM AIRCRAFT JET ENGINES. Mamuro, T.; Matsunami, T.; Matsuda, Y.; Mizohata, A. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 7-10(1973).

Particulate matter in emission gas from aircraft jet engines was subjected to instrumental neutron activation analysis and the compositions of trace elements, such as Na, Al, Cl, Sc, V, Cr, Mn, Fe, Co, Cu, Zn, Br, Sb and Th were determined. For comparison, airborne dust samples collected in and around the airport and a soot sample collected in a jet nozzle were also analyzed. The analytical results obtained involve some ambiguous points mainly resulting from the imperfect sampling method. The analytical sensitivity was insufficient because of the too small amount of collected samples. These should be improved in future studies. (auth)

5557 PRELIMINARY MULTIELEMENT ANALYSIS OF SIZE-SEPARATED AIRBORNE DUST PARTICLES. Mamuro, T.; Matsunami, T.; Matsuda, Y.; Mizohata, A. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 5-6(1973).

Preliminary multielement analysis was made of size-separated airborne dust samples collected by an Andersen sampler, preparatory to studying in greater detail how the elemental composition varied depending on the particle size. A circular thin polyethylene film was placed tightly on each collecting plate of the Andersen sampler and on this film size-separated dust particles were collected. The dust samples thus prepared were subjected to instrumental neutron activation analysis. The following was found as the result of the analysis. The elements, such as Sc, Fe, Ce, Sm and Th, show the trend that their concentrations increase with particle size. Most of these elements appear to be from the terrestrial origins. Contrary to this, the elements, such as Zn, As, Se, Br and Sb, show the reversed trend. They are mainly from industrial origins. On the other hand, the concentrations of Na, Cr, Co and Cs show no apparent dependency on the particle size. (auth)

5558 NONDESTRUCTIVE MULTIELEMENT ANALYSES OF AIRBORNE PARTICULATES BY COMBINED USES OF INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS AND ENERGY DISPERSIVE X-RAY FLUORESCENCE ANALYSIS. Mamuro, T.; Matsuda, Y.; Mizohata, A. Annu. Rep. Radiat. Center, Osaka Prefect.; 14: 1-4(1973).

Combined uses of instrumental neutron activation analysis and energy dispersive x-ray fluorescence analysis make it possible to analyze nondestructively a considerably large number of elements in airborne particulates. It was confirmed that up to 45 elements can be analyzed without any chemical procedures for urban airborne particulate samples. As the radiation spectrometry by semiconductor detectors and the automatic data reduction by electronic computation are quite common to the two techniques, combined uses of them produce no special annoyance. Several elements can be analyzed by both of them and therefore the reliability of the analytical results can be confirmed by comparing the data obtained by them with each other. It is noted that this confirmation can be made for the very same sample. Experiences in multielement analyses of airborne particulates and some problems to be solved in further studies are described. (auth)

5559 DETERMINATION OF IMPURITIES IN DIAMOND BY NUCLEAR METHODS. Sellschop, J. P. F.; Bibby, D. M.; Erasmus, C. S.; Mingay, D. W. (Univ. of Witwatersrand, Johannesburg). Diamond Res.; 43-50(1974).

A report is presented on the determination of impurities in diamond by neutron activation analysis and charged particle (activation) analysis. Details are given of the methods used for determination of nitrogen by alpha particle activation and of oxygen and silicon by fast neutron activation. Thermal neutron activation analysis was applied to the detection and estimation of a series of trace elements in diamond, including the following elements of importance in nuclear technology: V, Sc, Sr, La, Ce, Sm, Eu, Dy, Ho, Yb, Lu. The methods and the results are discussed. (UK)

5560 DETERMINATION OF TRACE ELEMENTS IN AIRBORNE PARTICULATE MATERIAL BY ACTIVATION ANALYSIS. Altan, T.; Kut, A.; Kut, D.; Olmez, I.; Pamuk, F. Tech. J., Ankara Nucl. Res. Cent.; 1: No. 1, 39-44(Feb 1974).

Several trace elements are being continuously introduced into the atmosphere by the burning of coal, oil, and refuse in addition to different gases, smoke, and dust. Some of these trace elements were determined by neutron activation analysis applying chemical separation and instrumental methods in Ankara air. Many of the elements found are highly toxic. (INIS)

5561 RADIOMETRIC AND NEUTRON ACTIVATION METHODS OF P_2O_5 DETERMINATION. Belyakov, M. A.; Terent'ev, Eh. P.; Akindinov, V. A. Khim. Prom. (Moscow); No. 1, 44-46 (1974). (In Russian).

For English translation see the journal Sov. Chem. Ind.

The results of the study and practical utilization of radiometric and neutron activation methods for the determination of P in raw materials are reported. On the basis of data obtained, the precision in the analysis of P_2O_5 is ~5 to 10 relative % in the radiometric method and ~1.0 to 2 relative % in the neutron activation method. (tr-INIS)

5562 DETERMINATION OF THE NITROGEN CONTENTS OF WHEAT GRAIN SAMPLES BY MEANS OF FAST NEUTRON ACTIVATION ANALYSIS. Sevimli, H.; Ozyol, H.; Barutcugil, E.; Dincer, S. (Ankara Nuklear Arastirma Merkezi (Turkey)). Tech. J., Ankara Nucl. Res. Cent.; 1: No. 1, 15-21(Feb 1974).

The nitrogen contents of wheat grain samples were determined by use of fast neutron activation analysis employing the reaction $^{14}N(n,2n)^{13}N$. Barley grain samples with known nitrogen contents were used as standards for the comparative activation analysis. As a result, the nitrogen amounts in fifteen varieties of wheat samples were found between, (2.69 ∓ 0.10) % and (1.53 ∓ 0.08) %. (INIS)

5563 ANALYSIS OF SOME MATERIALS BY ACTIVATION USING FAST NEUTRONS AND SEMICONDUCTOR GAMMA SPECTROMETER. Zakharov, E. A.; Krasnov, B. I.; Nikolaenko, O. K. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Radiatsionnoj Tekhniki, Moscow (USSR)). Izotopy SSSR; No. 330, 11-14(1973). (In Russian).

Experiments were made on the evaluation of the sensitivity and detection limits of some elements, among which are Zr, Mo, and V. A neutron generator was used for irradiation. The spectra of the elements studied were measured with semiconductor detectors. The activation analysis of Ti alloys was carried out with these detectors. (tr-INIS)

5564 CHARACTERIZATION OF SILICON METALLIZATION SYSTEMS USING ENERGETIC ION BACKSCATTERING. Borders, J. A.; Picraux, S. T. (Sandia Labs., Albuquerque, NM). Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1224-1231(Sep 1974).

Silicon metallization systems have become increasingly sophisticated in order to tailor contact properties such as adhesion, electrical conductivity, barrier height, and long-term reliability. These contact properties are highly susceptible to solid–solid reactions, typically involving atom migration over distances less than 1 μm. Analysis by monoenergetic ion beam irradiation is a valuable new materials characterization technique to optimize process parameters and contact lifetime. Energy analysis of the backscattered ions allows nondestructive determination of the depth distribution of the atomic composition of thin multilayered systems. Recent application of this technique has provided extensive data on the energetics and kinetics of interdiffusion and compound formation for thin-film metallizations on silicon, particularly those used in silicon device technology. After a brief introduction to the technique, the results of these studies are reviewed and systematized. Interdiffusion results are treated for silicon-metal and metal-metal reactions. Distinction is made between cases where internal surface transport effects dominate and cases where compound formation dominates. Examples are taken from each of these areas and are discussed in terms of metallurgical properties. (auth)

5565 SIMULTANEOUS DETERMINATION OF TITANIUM, ZIRCONIUM, AND NIOBIUM BY REACTOR NEUTRON ACTIVATION. Lee, C.; Yim, Y. C.; Chung, K. S. Daehan Hwahak Hwoejee; 18: No. 1, 40-49(1974).

The fission neutron reactions of $^{47}Ti(n,p)^{47}Sc$ and $^{93}Nb(n,\alpha)^{90m}Y$, along with epicadmium neutron reaction of $^{96}Zr(n,\gamma)^{97}Zr$ were used for the simultaneous determination of Ti, Nb, and Zr in a synthetic mixture. Prior to neutron irradiation, Ti, Zr, and Nb in the mixture were separated together in one group through the cation exchange column of Dowex 50 × 8 resin using 0.5M a-hydroxy-isobutyric acid as the eluent. After irradiation of the eluate the product nuclides, ^{97}Zr, ^{47}Sc and ^{90m}Y, were eluted sequentially through the same column with 0.5 Mα-HIBA, 0.5M α-HIBA-1 N HNO_3 and 0.5M α-HIBA-2N HNO_3 solution, respectively. The gamma spectrometry was used for the measurement of the gamma-ray activities of the eluted nuclides. The detection limits of Nb, Ti, and Zr were found to be 0.2, 0.01, and 0.002%, respectively. (Korean Sci. Abstr.)

Chemical and Spectral Procedures

Refer also to abstracts 5689, 5695, 6191, 6197, and 8040.

5566 (ARH-2835) DETERMINATION OF TRACE URANIUM IN PLUTONIUM BY X-RAY EMISSION SPECTROMETRY. Winters, W. I.; Metcalf, S. G. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). Jun 1974. Contract AT(45-1)-2130. 39p. (CONF-740848-1). Dep. NTIS $4.00.

A method for the determination of trace uranium; 200 parts uranium per million parts plutonium (ppM), in PuO_2 and $Pu(NO_3)_4$ used for Fast Flux Test Facility (FFTF) fuels has been developed using 0.1M tri-n-octylphosphine oxide (TOPO) to separate the uranium from plutonium, and x-ray emission to measure the uranium concentration. Plutonium dioxide is dissolved in HCl-HF, evaporated to dryness, and $AlCl_3$ added to complex residual fluoride. Following the reduction of Pu(IV) to Pu(III), uranium is extracted with 0.1M TOPO in cyclohexane from 2.0M $NH_2OH \cdot HCl$ and 4M HCl. The organic is mounted and dried on a paper pad and analyzed by x-ray emission. For $Pu(NO_3)_4$ solutions a thorium internal standard is used for the analysis. The relative standard deviation for the analysis of the FFTF PuO_2 standard supplied by Los Alamos Scientific Laboratory was ±8.9%. Two other extraction systems, TOPO in 2M HNO_3 and triisooctylamine (TIOA) in 2M $NH_2OH \cdot HCl$ and 4M HCl, have been studied and their advantages and limitations discussed. X-ray analysis permits the use of a faster separation for uranium than spectrophotometric methods and meets the sensitivity, accuracy, and precision required for analysis of FFTF materials. (auth)

5567 (BARC-738) SPECTROGRAPHIC DETERMINATION OF NOBLE AND OTHER METALS IN GRAPHITE. Chandola, L. C.; Mahajan, V. (Bhabha Atomic Research Centre, Bombay (India). Spectroscopy Div.). 1974. 17p. Dep. NTIS (U. S. Sales Only) $4.00.

An emission spectrographic method for the determination of Au, Ga, Hf, In, Ir, Pd, Pt, Re, Rh, and Ru in graphite powder has been standardized. The sample is mixed with Tl internal standard and loaded in a shallow cup (UCP 1991) graphite electrode. The spectra are excited in a d.c. arc run at 15 amperes current and recorded on Ilford N.30 emulsion plates, in the region 2500-3500 Å, employing a Hilger large quartz spectrograph. The lower determination limits for various elements are: Au, Ga and In, 10 ppm; Ir and Pd, 25 ppm; Re and Ru, 50 ppm; Pt, 100 ppm; and Hf and Rh, 250 ppm. The precision varies from ±12% for In to ±22% for Au. Experiments with synthetic samples show that estimations are within ±20% of the amounts added. (auth)

5568 (CONF-741023-4) ACCURACY IN DETERMINING TRACE ELEMENT CONCENTRATION IN MARINE SEDIMENTS. Wood, E. D.; Cintron, N. A. (Puerto Rico Univ., Mayaguez). 1974. 24p. Dep. NTIS $4.25.

From 7th materials research symposium; Gaithersburg, Maryland, USA (7 Oct 1974).

Replicate sediment samples were collected in the course of mapping a portion of the sea floor on the west coast of Puerto Rico. The location is in the discharge region of the Guanajibo River. Ten replicate grab samples were taken by independent positioning of the ship. The samples were stripped with hydrochloric acid and the resulting solutions analyzed by atomic absorption spectroscopy for Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Sr, and Zn. The standard deviations of replicate analyses of individual samples were generally less than for the individual samples themselves. Chemical standards were prepared and used to determine the value of the samples. Particle size and homogeneity are factors considered with respect to the number of replicates required and sample size. The average concentrations for several elements in a set of 10 samples with confidence limits for 95% level as determined by AAS are as follows: Cd, 0.840 ± 0.011; Co, 56.5 ± 0.2; Cr, 696 ± 8; Cu, 30.7 ± 0.4; Fe, 60000 ± 1010; Mn, 827 ± 5; Ni, 487 ± 5; Pb, 17.2 ± 0.2; and Zn, 70.3 ± 0.8 μ/g dry sediment. A composite sample from this location was prepared for use as a standard in future sediment analyses. (auth)

5569 (EURISOTOP-93) MEASUREMENT OF THE SULPHUR CONTENT OF REFINERY PRODUCTS BY X-RAY ABSORPTIOMETRY. Rowley, T. B. (Nuclear Enterprises Ltd., Reading (UK)). Sep 1974. Dep. NTIS (U. S. Sales Only). $4.25.

Reasons for removal of S from refinery products to meet environmental protection legislation and product specification and the conventional methods used for S determination are discussed. Two types of S monitors based on the use of isotope x-ray sources are described. One model is designed for use in process control laboratories giving considerable reduction of time required for S determination. The second model is for continuous on-line monitoring of product streams at line pressure and temperature. Digital signal processing is used in both models to achieve optimum precision. The economic advantages to refinery operation of rapid and continuous S measurement are briefly discussed. (auth)

5570 (UCRL-51683) ANALYSIS OF TANTALUM METAL FOR TRACE AMOUNTS OF NIOBIUM BY ENERGY-DISPERSIVE X-RAY FLUORESCENCE SPECTROMETRY. Ryon, R. W.; Handly, N. B.; Hill, J. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Oct 1974. Contract W-7405-Eng-48. 5p. Dep. NTIS $4.00.

A nondestructive method is described for quantitatively measuring trace amounts (0 to 500 ppM) of niobium in tantalum–niobium alloy sheets, turnings, and fabricated parts. The method, which makes use of an energy-dispersive x-ray spectrometer to compare the sample to be analyzed against known standard samples, can detect niobium levels as low as 10 ppM. (auth)

5571 COMPARATIVE STUDY OF SOME ELECTROCHEMICAL METHODS USED IN THE DETERMINATION OF U. Almagro Huertas, V. (Junta de Energia Nuclear, Madrid). Energ. Nucl. (Madrid); 19: No. 88, 103-108(1974). (In Spanish).

An experimental study was made of the various methods for the evaluation of U using electroanalytical techniques. The values obtained in routine use of these methods were compared. The techniques used were amperometric, coulometric, and classical and automated potentiometric methods. A study on the final results obtained in the polarography of U was included. (tr-auth)

5572 SOURCE AND MINERAL BATH WATERS OF TURKEY WITH RESPECT TO THEIR U CONTENT AND RADIOACTIVITY. Saygili, N.; Altan, T.; Pamuk, F. (Nuclear Research Center, Ankara). Tech. J., Ankara Nucl. Res. Cent.; 1: No. 3, 125-135 (Oct 1974). (In French).

The natural radioactivity and the U content were measured in a number of spring waters and mineral bath waters in Turkey. The natural radioactivity was determined by evaporation of a sample followed by β determination. The U was determined by fluorimetry. The results are tabulated. (JSR)

5573 DEUTERIUM AND FREE RADICALS IN THE RADON WATER OF BELOKURIKH HEALTH RESORT. Kaznacheev, V. P.; Kashafutdinova, Z. N.; Baibikov, E. V. (Novosibirsk Medical Inst., USSR). Vop. Kurortol., Fizioter. Lech. Fiz. Kul't.; 38: 275-276 (1973). (In Russian).

The average D content of the subject water (determined by mass spectrometry after decomposition of zinc) was 0.0140 mole %, compared to 0.0149 mole % in the Novosibirsk public water supply and in most river waters. Free radicals could not be detected by an EPR method (sensitivity 10^{-6} M). (tr-auth)

5574 SPECTROGRAPHIC DETERMINATION OF LEAD AND TELLURIUM IN Bi–Pb AND Bi–Te ALLOYS. Murty, P. S.; Khanna, P. P. (Bhabha Atomic Research Center, Bombay). Curr. Sci. (India); 43: No. 22, 711(20 Nov 1974).

Development of a spectrographic method to analyze lead and tellurium in Bi–Pb and Bi–Te alloys respectively using a single excitation condition is reported. (LK)

5575 AUTOMATED THERMIONIC MASS SPECTROMETRY BY COMPUTERIZED CLOSED-LOOP CONTROL. Brachmann, K. (Varian Mat GmbH., Bremen, Ger.); Heinen, G.; Markwardt, U.; Weber, E. Trans. Amer. Nucl. Soc.; 19: 217(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5576 NEW REDOX TITRANTS IN NON-AQUEOUS AND PARTIALLY AQUEOUS MEDIA. IV. Potentiometric Titrations Using Iodobenzene Dichloride in Acetic Acid Medium. Nair, C. G. R.; Nambisan, K. (Univ. of Kerala, Trivandrum, India). Indian J. Chem.; 12: No. 6, 645-647(Jun 1974).

Iodobenzene dichloride, a new oxidimetric reagent is proposed for titrations in acetic acid medium. Procedures for the potentiometric titrations in purely non-aqueous or partially aqueous medium of the following reductants are described: ascorbic acid, arsenic(III), iodide, thallium(I), aniline, phenol, and 8-hydroxyquinoline. (auth)

5577 SPEKTRAL'NYI ANALIZ REDKOZEMEL'NYKH OKISLOV. (Spectral Analysis of Rare Earth Oxides). Karyakin, A. V.; Anikina, L. I.; Pavlenko, L. I.; Laktionova, N. V. Moscow; Izdatel'stvo Nauka (1974). 154p.

Spectral methods for the analysis of rare earth elements are examined. Data on the physical chemical properties of the rare earth elements, the results of studies of processes in the discharge zone, methods of determination of non-rare earth and rare earth impurities in the oxides are reported. (tr-auth)

5578 SENSITIVITY CALIBRATION IN SPARK SOURCE MASS SPECTROMETRY. Jaworski, J. F.; Morrison, G. H. (Cornell Univ., Ithaca, NY). Anal. Chem.; 46: No. 14, 2080-2084(Dec 1974).

Relative sensitivity coefficients (RSC's) have been determined for over 23 elements in geological, metallurgical, and biological matrices. Special attention was given to elimination of errors due to interferences, inhomogeneity, variation of instrumental parameters, and inconsistent photographic measurement. Results indicate that RSC's varied from matrix to matrix by only 10–30% on the average. RSC's were readily calculable using an existing theory based on thermodynamic considerations. (auth)

5579 POLAROGRAPHIC DETERMINATION OF TELLURIUM(IV) WITH TETRAETHYLENE PENTAMINE. Rao, A. L. J.; Kumar, Ashok (Punjabi Univ., Patiala (India). Dept. of Chemistry). Trans. Soc. Advan. Electrochem. Sci. Technol.; 9: No. 1, 24-25 (Jan 1974).

4 refs.

A polarographic method for the determination of Te(IV) using tetraethylene-pentamine as base electrolyte in the presence of HCl is described. Tellurium gives a well defined diffusion controlled, irreversible wave in 0.3 M tetraethylene-pentamine and 0.1 M HCl with half wave potential at –0.84 V. This reduction wave is used for the determination of tellurium. (INIS)

5580 NEW SUBSTITUTED HYDROXAMIC ACID DERIVATIVES AS SPECTROPHOTOMETRIC REAGENTS FOR NIOBIUM(V). Savariar, C. P.; Joseph, Joy (Calicut Univ. (India). Dept. of Chemistry). J. Indian Chem. Soc.; 50: No. 8, 528-530(Aug 1973).

8 refs., 2 tables.

Methyl and halogen substituted derivatives of N-acetylsalicyloyl-N-phenylhydroxylamine (ASPHA) and N-p-nitrobenzoyl-N-phenylhydroxylamine are synthesized and used for the spectrophotometric determination of niobium(V). These reagents form deep yellow complexes with niobium(V) and thiocyanate in strong hydrochloric acid media which can be extracted into carbon tetrachloride or chloroform. The complexes absorb strongly around 400 nm and the sensitivities are about 0.005 μg. Nb per ml. A large excess of associated ions, including Ta(V), is tolerated. (auth)

5581 QUANTITATIVE ANALYSIS OF MIXTURES OF HARDLY VOLATILE COMPOUNDS OF CHEMICAL ELEMENT USING MASS-SPECTROMETER. Semyannikov, P. P.; Lyubimov, V. N.; Grankin, V. M. (AN SSSR, Novosibirsk. Inst. Neorganicheskoj Khimii). Dokl. Akad. Nauk SSSR; 213: No. 6, 1342-1344(21 Dec 1973). (In Russian).

For English translation see the journal Dokl. Chem.

A method is proposed for the analysis of a mixture whose qualitative composition is known. By the addition of chemical reagents to the mixture similar gaseous products are formed from each component. The reaction of each component begins at a predetermined threshold temperature. A mass spectrometer is used for the quantitative determination of the gaseous products. The method was used for the determination of the components in boron compounds of low volatility. Fluorination was selected as the initial reaction. The method was tested on steels containing B, BN, and ZrB_2, on mixtures of BN and B, and on mixtures of salts of boric acid. (tr-auth)

5582 SIMULTANEOUS PHOTOMETRIC DETERMINATION OF MOLYBDENUM AND IRON IN TITANIUM ALLOYS. Engel, O. (Vyzkummny a Zkusebni Ustav SONP, Kladno (Czechoslovakia)). Hutn. Listy; 28: No. 11, 816-819(Nov 1973). (In Czech).

The optimum uv wavelengths and HCl concentrations were defined for spectrophotometric Fe and Mo determination in HCl medium. In the simultaneous determination the HCl molarity is observed with an accuracy of ±0.02 M. The calibration and the calculation of Mo and Fe contents in a sample are presented. Extraction of Fe and Mo chlorocomplexes into methyl isobutyl ketone from 6M HCl was found to be the most suitable method of separating Fe and Mo from Ti and from other interfering elements. The detailed procedure of the determination is given. (INIS)

5583 SPECTROPHOTOMETRIC STUDIES OF YTTRIUM(III) COMPLEXES WITH SOLOCHROME CYANINE-R AND ERIOCHROME OZUROL-B. Pande, S. P.; Munshi, K. S. (Nagpur Univ. (India). Dept. of Chemistry). J. Indian Chem. Soc.; 50: No. 10, 649-650 (Oct 1973).

7 refs.

Solochrome Cyanine R (SCR) and Eriochrome Azurol B (ECAB) were recommended as sensitive reagents for the spectrophotometric determination of ytrium (III) in aqueous solution. The composition was found to be 1 : 1 and 1 : 2 (metal: reagent) for Y(III)-SCR and Y(III)-ECAB chelates respectively. The stability constants of the chelates were determined by Job's method and limiting logarithmic method, at four different fixed values of ionic strength. The value of thermodynamic stability constant of the chelates have been determined to be 5.0 ± 0.2 for Y (III)-SCR chelate and 9.6 ± 0.2 for Y (III)-ECAB chelate respectively. The study also includes the analytical applications of the chelates. (auth)

5584 CHEMICAL-SPECTROSCOPIC DETERMINATION OF Y, La, AND Ce WITH AN IODIDE EXTRACTION SYSTEM. Kalmykova, I. S.; Mezentseva, V. F.; Ponosova, E. V. Zh. Prikl. Spektrosk.; 21: No. 2, 329-331(Aug 1974). (In Russian).

Y, La, and Ce were extracted from a 2:3 chloroform-benzene mixture from the third phase formed in an iodide system with dinitrilomethane (DAM). The optimum concentrations in the third phase were 0.05 N HCl in 50 ml of the aqueous layer, 2.5 g of DAM, 3 g of KI, and 15 ml of chloroform-benzene mixture. The third phase concentrate was brought by drops to five carbon electrodes and the spectrum analyzed. All five electrodes were photographed on one spectrum without moving the cassette. The calibration graph was made by extracting different microgram amounts of Y, La, and Ce and 10 μg of ytterbium, as a comparison element, and spectrographing under similar conditions. The sensitivity of the method to Y, La, and Ce was 0.2, 3, and 4 μg/ml, respectively. The relative error was no greater than 15%. (tr-auth)

5585 EQUIPMENT FOR RESOLVING WEAK SPECTRAL LINES ON A BACKGROUND OF CONSTANT RADIATION. Katskov, D. A.; Kruglikova, L. P.; L'vov, B. V.; Orlov, N. A.; Polzik, L. K. Zh. Prikl. Spektrosk.; 21: No. 2, 366-371(Aug 1974). (In Russian).

The possibility of using analysis of differential emission spectra for quantitative determination of elements was studied. Derived spectra were obtained by periodic scanning of the parts of the spectra close to the analytical lines with synchronous detection of the harmonic components of the signal. Simple modulation equipment was made. The advantages of the method are described for determining a number of elements at a level of 10^{-9} to 10^{-13} g with intense heat radiation on the analytical line and for determining elements from lines located in the molecular band field and continuous flame spectra. (tr-auth)

5586 DIFFUSION CONTROLLED, THERMAL IONIZATION SOURCE FOR THE MASS SPECTROMETRIC ANALYSIS OF TRACE METALS. Rec, J. R. Troy, NY; Rensselaer Polytechnic Inst. (1974). 249p. University Microfilms Order No. 74-26,090.

Thesis (Ph. D.).

Thermal ionization mass spectrometry offers a method of analysis for trace metals, both stable and radioactive. The sensitivity of the mass spectrometric method is basically limited by the technique used to ionize the sample atoms. The direct evaporation, thermal ionization source is generally used to provide a source of sample atoms for mass analysis. This technique is inefficient, because ionization maximization and evaporation rate cannot be controlled independently. A technique for increasing the ionization efficiency in the thermal ionization source involves encapsulating the sample atoms in a matrix of a high work function, refractory metal and allowing diffusion to control the rate of arrival of sample atoms on the ionization surface. Because diffusion is a much slower process than direct evaporation at comparable temperatures, this source can be operated at higher temperatures which result in higher sample utilization efficiencies. The diffusion controlled, thermal ionization source is evaluated in this work. Samples of uranium and plutonium were encapsulated in high work function metal matrices using the technique of rf sputtering. Three metals, nickel, tungsten, and rhenium were evaluated as coating material candidates. Analysis for uranium and plutonium were performed in a two stage, double focusing mass spectrometer. Ion emission rates for diffusion controlled sources were compared, in each analysis, with ion emission rates from direct evaporation sources. Two of the coating materials, nickel and tungsten, were found to be unsatisfactory. Nickel, which has a melting point of 1453°C, evaporated from the surface at temperatures below the operating range of the diffusion controlled source for uranium and plutonium. Tungsten coatings contained numerous defects, primarily stress relieving microcracks, and exhibited low work function surfaces. Rhenium coatings were found to be relatively defect free and to have work function surfaces similar to the pure metal. Mass spectrometric analyses of uranium and plutonium samples indicated that the diffusion controlled source was at least four times more efficient in sample utilization than the direct evaporation source. Ionization efficiencies of better than 10% were estimated. Sensitivities of better than 1×10^{-15} gms plutonium in the source were easily attained. Based on similar analyses for uranium, a comparable sensitivity is estimated for this element. Overall, the diffusion controlled source consistently operated as predicted and greatly improved the control of ion emission from very small samples ($< 10^{-11}$ gms). The results of analyses of two environmental type samples containing uranium and plutonium proved the applicability of this technique for routine monitoring. The quantitative and isotopic information on uranium and plutonium obtained from the analyses agreed well with the measurements using alpha particle spectroscopy. The information obtained was complementary to and consistent with that obtained by alpha particle spectroscopy. (Diss. Abstr. Int., B)

Radiometric and Radiochemical Procedures

Refer also to abstracts 5981, 5983, 5984, 5999, 6052, 6058, 6071, 6078, and 6132.

5587 GEL COUNTING OF ^{14}C AND ^{3}H. Krisnamoorthy, T. M.; Soman, S. D. (Bhabha Atomic Research Center, Bombay). Curr. Sci. (India); 43: No. 22, 703-705(20 Nov 1974).

Aluminum stearate gel in toluene base scintillator is employed for the measurement of varied amounts of carbon-14 labelled $BaCO_3$ and tritiated lysine and the counting efficiencies are compared with the solution counting. $BaCO_3$ particulates in the ranges of $74 < X < 105$ μ dia. and $105 < X < 416$ μ dia. do not affect the gel counting efficiency. Sample weights up to 100 mg do not cause any significant change in the gel counting efficiency while further increase in weight definitely lowers the efficiency. A comparison is made of the direct counting of carbon-14 labelled $BaCO_3$ particulates with that of the gel suspension counting. Gel counting efficiency for tritium is found to be of the order of 1% of the solution counting. For carbon-14 this is about 92 ± 4% of the solution counting in the weight range up to 100 mg $BaCO_3$. (auth)

5588 ANALYSIS OF URANIUM AND THORIUM ORES USING A GAMMA RAY SPECTROMETER WITH A Ge(Li) DETECTOR. Gorbatyuk, O. V.; Kadisov, E. M.; Miller, V. L.; Shashkin, V. L. Sov. At. Energy (Engl. Transl.); 35: No. 5, 1037-1040(Nov 1973).

Translated from At. Energ. (USSR); 35: No. 5, 352-355(Nov 1973).

A gamma-ray spectrometer with a Ge(Li) detector was used to determine the uranium, radium, radon, and thorium contents of ore samples from a single measurement. The determination is done by using characteristic lines in the γ-ray spectra of the elements being determined or their decay products in equilibrium with them. (LK)

5589 POSSIBILITIES OF DETERMINING URANIUM AND RADIUM CONTENT OF ORES BY MEASURING GAMMA RADIATION IN A BOREHOLE USING A SPECTROMETER WITH A Ge(Li) DETECTOR. Gorbatyuk, O. V.; Kadisov, E. M.; Miller, V. V.; Troitskii, S. G. Sov. At. Energy (Engl. Transl.); 35: No. 5, 1041-1043(Nov 1973).

Translated from At. Energ. (USSR); 35: No. 5, 355-357(Nov 1973).

The possibility of making an independent determination of uranium and radium which does not depend on weak emanation of the ore was examined. In this method the uranium content is determined first from the intensities of the γ-ray lines from isotopes which are always in equilibrium with ^{238}U in ores, and then the radium content is determined from the size of the 186-keV peak, taking account of the contribution of the uranium γ-radiation. (LK)

5590 MESSUNG VON RADIOAKTIVEN UND STABILEN ISOTOPEN. (Experimental Determination of Radioactive and Stable Isotopes). Simon, H. (ed.); Rauschenbach, P.; Schmidt, H. L.; Tykva, R.; Wenzel, M. Anwendung von Isotopen in der Organischen Chemie und Biochemie. Berlin, F. R. Germany; Springer (1974). 430p. (In German). (ISBN-3540065873).

87 figs.; with tabs.; 446 refs.

Following general consideration on activity measurement and its sources of error, the book deals with the preparation of measuring samples, determination of low activities, measurement of multi-labelled samples and the radiochromatography. Finally, the analysis of stable isotope labelled compounds is gone into. (GE)

5591 RAPID ANALYSIS OF RADIOACTIVE RUTHENIUM IN WATER SAMPLES. Haberer, K.; Stuerzer, U. Gas-Wasserfach, Wasser-Abwasser; 115: No. 4, 181-183(Apr 1974). (In German).

2 tabs.; 26 refs.

The possibility of rapid determination of radioactive ruthenium in water samples as ruthenium sulfide (method A) or as ruthenium tetroxide (method B) was tested. Both methods are suitable for water samples with relatively high content of radioruthenium (at least 50-fold the natural background radiation of the counter device). However, as the yield of method B decreases with increasing water volume, preference is given to method A. (GE)

5592 ANALYTICAL CONSIDERATIONS CONNECTED WITH THE TRANSURANIUM ELEMENTS. Wessman, R. A.; Lee, K. D.;

Major, W. J.; Leventhal, L. (LFE Environmental Analysis Labs., Richmond, CA). Trans. Amer. Nucl. Soc.; 19: 74(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5593 USKh-1 SCINTILLATION CHROMATOGRAPHIC EQUIPMENT FOR DETERMINATION OF RADIOACTIVITY IN SPOTS ON THIN-LAYER AND PAPER CHROMATOGRAMS. Vdovenko, V. M.; Bobrova, V. N.; Rys'ev, O. A.; Surov, N. A. (Radievyj Inst., Leningrad (USSR)); Vinogradova, R. G.; Luzin, I. E.; Romanov, F. I. (AN SSSR, Leningrad. Spetsial'noe Konstruktorskoe Byuro Analiticheskogo Priborostroeniya). Izotopy SSSR; No. 30, 20-25 (1973). (In Russian).
The subject equipment is based on a scintillation method for measuring radioactivity. Basically, the method of measurement is one of "dry" scintillators and permits recording the radioactivity of chromatographic spots of preparations labeled with tritium and ^{14}C. (tr-auth)

5594 RADIOTRACER METHODS FOR QUANTITATIVE DETERMINATION OF DIMETHOATE AS A PLANT PROTECTIVE. Luther, D.; Schindler, M.; Roesseler, M. (Zentralinstitut fuer Isotopen- und Strahlenforschung, Leipzig). Isotopenpraxis; 10: No. 8, 298-302(Aug 1974). (In German).
Possibilities of the application of radiotracer methods for the optimization of analytical methods of quantitative determination of dimethoate as a plant protective are presented with checking of an extractive separation process as part of the titrimetric dimethoate determination provided as an example. For the analysis of agent samples of different origin a method based on isotope dilution has been developed which, owing to its simplicity and easy reproducibility of yielded results, may be recommended as an arbitration method for the comparison of analytic results. (auth)

5595 ELEMENTAL ANALYSIS OF AIRBORNE DUST BY ENERGY DISPERSIVE FLUORESCENT X-RAY SPECTROMETRY (II). Mizohata, A.; Mamuro, T. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 19-22(1973).
A method of correction for the matrix absorption effect is described and some analytical results obtained for ^{109}Cd excitation making use of this correction method are illustrated. The limits of detection of various elements by the present analytical system are also shown. (auth)

5596 PROMPT GAMMA RAY ANALYSIS OF BONE USING ^{252}Cf. Giarratano, J. C. Austin, TX; Univ. of Texas (1974). 231p. University Microfilms Order No. 74-24,863.
Thesis (Ph. D.).
A system was constructed to investigate the feasibility of prompt gamma ray analysis using ^{252}Cf to determine bone calcium; activation analysis using ^{252}Cf was also studied, and the two methods compared. The results of various sample analyses and times were analyzed. A comparison showed that the prompt gamma system was 35.4 times as sensitive as the activation analysis system for the detection of calcium, 154 times as sensitive for chlorine, and 1.78 times as sensitive for sodium. The sensitivity for phosphorus and that of hydrogen was also determined for the prompt system. An excised human lumbar vertebra was also analyzed by the prompt method; the results for calcium were compared to the published values for this type of bone and found to be within the limits of precision for the system. (LK)

5597 SORPTION-EMANATION METHOD FOR SOLUBLE RADIUM IN WATERS. Kobal, I.; Shahin, M.; Kristan, J.; Senegacnik, M. (Institut Jozef Stefan, Ljubljana, Yugoslavia). Health Phys.; 27: No. 4, 381-384(Oct 1974).
A method is described for the determination of soluble ^{226}Ra in waters. Radium from a filtered 20-l. water sample was sorbed on an ion exchange resin (Dowex 50 W × 8). Then the vessel containing the ion exchanger was closed for a time and the emanated radon determined using a scintillation cell. The sensitivity of this method is 0.03 pCi of ^{226}Ra per liter of water, but it can be higher by taking greater volumes of samples. (auth)

5598 STUDIES OF THE CHEMICAL COMPOSITION OF THE MOON. Steinnes, E. (Instituut for Atomenergi, Kjeller, Norway). Astron. Tidsskr.; 7: No. 2, 69-74(1974). (In Norwegian).
The three methods of analysis of geological material on or from the moon are described. These are, first in situ chemical analyses using an alpha source and analysing the reflected alpha particles and protons resulting from (α,p) reactions. Such analyses were carried out by the "Surveyor" probes. Second are the chemical analysis, mostly by activation analysis or mass spectrometry with isotope dilution, of samples brought back by the Apollo and Luna expeditions. The third are measurements made from a spaceship (Apollo 15) in orbit, either by analysis of characteristic x radiation emitted following excitation by solar x radiation, or by gamma spectrometry. It has been found that the mare districts have basalitic rocks, mainly consisting of pyroxine, olivine, plagioklas and ilmenite. The relative amounts are however not the same as on the earth. The moon's highlands rocks of anothositic character are found, containing high concentrations of aluminium and calcium, and correspondingly low concentrations of iron and titanium. The geological results show that eruptive activity ceased about 3 million years ago, that the oldest rocks are the highland rocks, about 4.1 million years while the basalts are 3.3 to 3.9 million years old. The cooling process accounting for these distributions is outlined. The question of the origin of the moon has however not been clarified. (NO)

5599 DETERMINATION OF RADON-222 CONCENTRATIONS BY AN INTEGRATED COUNT METHOD. Jonassen, N.; Clements, W. E. (Danmarks Tekniska Hoejskole, Lyngby). Health Phys.; 27: No. 4, 347-351(Oct 1974).
An integrated α count method for the determination of the concentration of ^{222}Rn is described which does not require equilibrium between radon and its short-lived daughters. The initial radon activity R_0 is shown to be proportional to the total α disintegrations I_t in a time interval from t_1 to t_2 through a proportionality factor $F(t_1,t_2)$. It is also shown that the accuracy of the method depends on the length of the counting period rather than on the time elapsed since sampling as long as this is short compared to the half life of ^{222}Rn. (auth)

5600 X-RAY EXCITED OPTICAL FLUORESCENCE OF GASEOUS ATMOSPHERIC POLLUTANTS: ANALYTICAL FEASIBILITY STUDY. Goldstein, S. A.; D'Silva, A. P.; Fassel, V. A. (Iowa State Univ., Ames). Radiat. Res.; 59: No. 2, 422-437(Aug 1974).
Optical fluorescence from molecular gases and metallic vapors in argon and helium has been elicited by irradiating gas mixtures with soft X rays. Emission spectra from species of interest in toxicological and environmental studies, e.g., NO, NO_2, CO, SO_2, and Hg, have been produced and characterized. Probable energy transfer processes accounting for the observed excitation are presented. These include non-selective direct routes involving collisions with photoelectrons, selective indirect routes involving collisions with excited atoms, e.g., sensitized fluorescence, Penning ionization (Jesse effect), and charge transfer, and routes involving relaxation phenomena, e.g., recombination and cascade. The development of an analytical technique for the determination of the previous molecular species, in addition to N_2 and OH, as part per million level impurities in rare gases was found to be highly feasible. The determination of molecular pollutants in air samples, however, was hampered by the process of quenching by ground state nitrogen and oxygen molecules. (auth)

Separation Procedures

Refer also to abstract 5727.

5601 (CEA-CONF-2631) SYNERGISM IN LIQUID-LIQUID EXTRACTION. Madic, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). [nd]. 30p. (In French). (CONF-720660-2). Dep. NTIS (US Sales Only) $4.50.
From 31st congress of the group for the advancement of physical methods of analysis; Paris, France (5 Jun 1972).
The phenomenon of synergism in liquid-liquid extraction is defined. Examples of synergism occurring with TTA in association with neutral exchangers and with cation exchangers are given and discussed. The parameters affecting synergisms are determined. The concepts of negative synergism and antagonistic phenomenon are defined and examples are given for TTA. Analytical and industrial applications of synergism are given. (JSR)

5602 USE OF THIRD-ORDER PLANNING IN ORDER TO SIMULATE THE EXTRACTION OF ZIRCONIUM WITH TRIBUTYL PHOSPHATE. Nikitina, E. P.; Granovskii, Yu. V.; Komissarova, L. N.; Smirnova, N. S.; Maksimova, E. P.; Nikolaeva, L. S.; Chernova, N. A. (Moscow State Univ.). Ind. Lab. (USSR) (Engl. Transl.); 40: No. 5, 701-704(May 1974).
Translated from Zavod. Lab.; 40: No. 5, 566-569(May 1974).
This paper is devoted to the construction of a model of the third order representing the extraction of zirconium by tributyl phosphate in a region of factor space which cannot be approximated by a polynomial of the second order. (auth)

5603 BIOSYNTHESIS OF HOP BITTER COMPOUNDS. P. 2. Gas Chromatography and Reaction Radio Gas Chromatography of Bitter Substances, Precursors and Metabolities. Drawert, F.; Beier, J. (Technische Univ. Muenchen, Weihenstephan (F. R. Germany). Inst. fuer Chemisch-Technische Analyse und Chemische Lebensmitteltechnologie). Chromatographia; 7: No. 6, 273-282 (Jun 1974). (In German).

6 figs.; 2 tabs.; 35 refs. Part of a thesis by J. Beier.

Reliable procedures for analyzing and studying the biosynthesis of labile hop bitter compounds by means of gas chromatography were developed, as well as methods of extraction and fractionation. Derivatives of desoxyhumulones, humulones, and lupulones obtained by reaction with hexamethyldisilazane in dimethylformamide can be chromatographed in an all-glass system without any notable decomposition. The same is true of the radio gas chromatographic estimation of ^{14}C- and ^{3}H-labelled compounds. (auth)

5604 SYNERGISM IN CESIUM EXTRACTION BY THE PARA-ALKYLPHENOL C_8-C_9 FRACTION. Abisheva, Z. S.; Plyushchev, V. E.; Reznik, A. M. (Moscow Inst. of Fine Chemical Tech.). Zh. Neorg. Khim.; 19: No. 10, 2843-2844(Oct 1974). (In Russian).

Cesium extraction by mixtures of the para-alkylphenol C_8-C_9 fraction with di(2-ethylhexyl) phosphoric acid, naphthenic acids, enanthic acid, and pelargonic acid was studied. The synergism was insignificant in alkaline solutions but increased in weakly acid and neutral solutions. (tr-auth)

5605 EXTRACTION OF MOLYBDENUM BY DIOXY ALKENEDIPHOSPHINE. Berkman, Z. A.; Bertina, L. Z.; Vol'dman, G. M.; Zelikman, A. N.; Kabachnik, M. I.; Kossykh, V. G.; Medved, T. Ya.; Nesterova, N. P.; Rozen, A. M.; Yudina, K. S. Zh. Neorg. Khim.; 19: No. 10, 2839-2842(Oct 1974). (In Russian).

Extraction of Mo phospholigands from nitric acid solutions in the presence of hydrogen peroxide by dioxy alkenediphosphine was studied. The most efficient extractant was dioxy-cis-tetraphenylvinylene diphosphine, which was 10^4 times as efficient as TBP. The composition of the complex formed was determined. (tr-auth)

5606 DETERMINATION OF RUTHENIUM OXIDATION STATE IN THE COMPLEX EXTRACTED WITH DIETHYLTHIOUREA. Petrukhin, O. M.; Marov, I. N.; Shevchenko, V. N.; Zhukov, V. V.; Ermakov, A. N. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Zh. Neorg. Khim.; 19: No. 10, 2831-2833 (Oct 1974). (In Russian).

The EPR spectra of the ruthenium complexes formed under extraction-photometric conditions of determination of ruthenium with diphenylthiourea were studied. Ruthenium was found in the +3 state in the form of several complexes, the composition of which depended on the conditions and the length of time the extracts were held. When the extraction was from a pre-processed solution of Sn(II) chloride, the extracted complexes did not give an EPR signal. (tr-auth)

5607 EFFECTS OF CONCENTRATION, CURRENT DENSITY AND FLOW RATE IN ELECTRODIALYSIS WITH ION EXCHANGE MEMBRANES. Miyoshi, H.; Fukumoto, T.; Tsurugi, J.; Kataoka, T. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 63-68(1973).

The electrodialytic method with ion exchange membranes has been mainly used as the condensing operation or the desalting operation of brackish water, but an agreed view about ion transfer in the electrodialytic system was not given. Accordingly, we carried out the investigation on the influence of direct current, concentration difference and flow velocity to ion transfer in electrodialysis. In this case, the experiment was taken under the isothermal and isobaric conditions. From the experiment, it was found that the contribution of the concentration difference between the condensed solution and the desalted one to the mass flux caused by the diffusion was negligible compared with the contribution by the current density. That is, the mass flux was proportional to the current density. In addition, the concentration difference between the condensed solution and the desalted one was found to be constant for a wide concentration range of the feed solution, and to be proportional to the current density and inversely proportional to the flow rate. (auth)

5608 ZIRCONIUM NITRATE EXTRACTION AS A FUNCTION OF INITIAL COMPOUNDS USED IN MAKING THE SOLUTION. Sarsenov, A.; Din Tkhi Lien; Sinegribova, O. A.; Yagodin, G. A. (Moscow Chemical-Technical Inst.). Zh. Neorg. Khim.; 19: No. 9, 2519-2522(Sep 1974). (In Russian).

Zirconium alpha-oxynitrate was made from the alpha-oxychloride by anion exchange. The oxynitrate and hydrolyzed zirconium nitrates of different compositions were used as the starting materials for making nitrate solutions with the same zirconium and nitric acid contents. The extraction of zirconium from these solutions by TBP (apparent extraction constants) differed. The maximum constant was obtained by using zirconium alpha-oxynitrate as the initial substance. It agreed in value with the extraction constant of zirconium nitrate obtained by re-extraction from the TBP phase. (tr-auth)

5609 PURIFICATION OF PLATINUM. Caldwell, C. E.; Ficklin, A. C. (to United States Atomic Energy Commission). US Patent 3,841,863. 15 Oct 1974. Filed date 12 Apr 1973. 4p.

The invention comprises separation of platinum from a material containing platinum together with one or both of plutonium and uranium. The material is heated with lead to effect dissolution and formation of a platinum, plutonium and/or uranium melt, cooling the same to solidification, contacting the solidified product with an acid solution to dissolve the lead and the plutonium and/or uranium, and thereafter separating and recovering undissolved platinum. (auth)

5610 THE EXTRACTION OF URANIUM(IV) FROM MIXED AQUEOUS-ORGANIC SOLUTIONS OF NITRIC ACID WITH TRIOCTYLMETHYLAMMONIUMNITRATE (ALIQUAT 336). Juenger, E.; Schmid, E. R. (Vienna Univ. (Austria). Analytisches Inst.). Monatsh. Chem.; 105: No. 1, 148-155(Jan 1974). (In German).

The extraction of uranium(IV) from methanolic and ethanolic nitric acid solutions was investigated. The results are discussed with regard to the complex equilibrium in the mixed aqueous–organic phase and the extraction of acid into the organic phase. (auth)

5611 CO-EXTRACTION AND SEPARATE RECOVERY OF URANIUM AND THORIUM FROM ACID SOLUTIONS. Ritcey, G. M.; Lucas, B. H. (to Canadian Patents and Development Ltd.). US Patent 3,835,213. 10 Sep 1974. Filed date 1 Oct 1971. 6p.

A process is described for separating uranium and thorium from an aqueous acid solution containing them together with rare earth elements. The process comprises contacting the solution with a water-immiscible organic solution of a high molecular weight primary or secondary amine whereby the uranium and thorium values are co-extracted and separating the resulting uranium and thorium loaded amine solution from the aqueous solution. The uranium and thorium are then easily separated from the loaded amine solution either by selective stripping or co-stripping and selective extraction. (Official Gazette)

Inorganic, Organic, and Physical Chemistry

Refer also to abstract 6529.

5612 DESYATAYA UKRAINSKAYA RESPUBLIKANSKAYA PO FIZICHESKOI KHIMII, DONETSK, SSSR, 10–13 OKTYABRYA 1972 G. (Abstracts of the Tenth Ukrainian Republic Conference on Physical Chemistry, Donetsk, USSR, October 10–13, 1972). Gilelakh, V. I. (ed.). Kiev; Izdatel'stvo Naukova Dumka (1972). 166p. (CONF-7210127–(Absts.)).

From 10th Ukrainian Republic conference on physical chemistry; Donetsk, USSR (10 Oct 1972).

Abstracts of the papers presented at the 10th Conference are compiled. The two topics of the Conference were kinetics and mechanisms of chemical reactions and structure and spectra of molecules. (JSR)

Chemical and Physicochemical Properties

Refer also to abstract 5673.

5613 (COO-1109-78) SOLID STATE CHEMISTRY OF RARE EARTH OXIDES. Technical Progress Report, 1973–1974. Eyring, L.; Lowe, A.; Lundberg, M.; Summerville, E.; Skarnulis, A. J. (Arizona State Univ., Tempe (USA)). 28 Jun 1974. Contract AT(11-1)-1109. 119p. Dep. NTIS $9.00.

Progress is reported in the following research areas: electron optical study of Pr_7O_{12} at 3.5 Å resolution; crystal chemistry of rare earth oxides as observed by high resolution lattice imaging; and preparation and structural studies of praseodymium oxyfluoride crystals. (LK)

5614 ELECTRON WORK FUNCTION AND CATALYTIC ACTIVITY OF AMMONIA-SYNTHESIS MELTED IRON CATALYSTS PROMOTED BY OXIDES OF SCANDIUM AND RARE EARTH ELEMENTS. Berengarten, M. G.; Rudnitskij, L. A.; Rabina, P. D.; Kuznetsov, L. D.; Zubova, I. E.; Alekseev, A. M.; Zakieva, K. Z. (Gosudarstvennyj Nauchno-Issledovatel'skij i Proektnyj Inst. Azotnoj Promyshlennosti i Produktov Organicheskogo Sinteza, Moscow (USSR); Moskovskij Khimiko-Tekhnologicheskij Inst. (USSR)). Dokl. Akad. Nauk SSSR; 214: No. 3, 601-604(21 Jan 1974). (In Russian).

For English translation see the journal Dokl. Phys. Chem.

The results are reported of measuring the specific catalytic activity and the electron work function of two promotor catalysts in ammonia synthesis, containing scandium or rare earth oxides as

structural promotor and potassium oxide as modifying promotor. This makes it possible to verify and determine in detail the promotor mechanism. The data obtained show that introduction of the modifying promotor potassium oxide increases the activity of all catalysts and decreases their electron work function. The utilization coefficients of the alkali promotor were determined. The large increase in the utilization coefficient of the alkali promotor is one of the basic differences in catalysts with the structural promotors scandium or rare earth oxides from Al_2O_3, a holding catalyst. It is shown that the nature of the structural promotor has a considerable effect on the catalyst activity only with a nonpolar covering of the surface by the active particles. (INIS)

5615 INVESTIGATION OF MIXED OXIDE CATALYST MODIFICATION BY THE GAMMA RESONANCE SPECTROSCOPY METHOD. Firsova, A. A.; Imshennik, V. K.; Maksimov, Yu. V.; Margolis, L. Ya.; Suzdalev, I. P. (AN SSSR, Moscow. Inst. Khimicheskoj Fiziki). Dokl. Akad. Nauk SSSR; 214: No. 3, 621-624 (21 Jan 1974). (In Russian).

For English translation see the journal Dokl. Phys. Chem.

Cobalt molybdate catalysts containing as an additive tellurium or iron (Co–Mo–Te and Co–Mo–Fe) were studied. Gamma resonance spectra were obtained. The state of the tellurium and iron ions in the catalyst was studied as well as the mutual effect of one additive on the state of the other. X-ray studies showed that the additives change the structure of the cobalt molybdate. The gamma resonance spectra indicate that the Te and Fe enter into the lattice of the solid substance and change the surrounding ions, creating additional defects. The cobalt molybdate lattice readily undergoes isomorphous conversion. Introduction of the additive stabilizes the cobalt molybdate structure, establishing a definite phase ratio, and affects the catalytic activity. Changes in the Te and Fe valence indicate that the additive not only affects the structure but also increases the electron interaction between ions that enter into the catalyst composition and the components of the reaction mixture. (tr-INIS)

5616 SOLUTION ABSORPTION SPECTRUM OF EUROPIUM(III) IN THE VISIBLE REGION. Peacock, R. D. (King's Coll., London); Chrysochoos, J. J. Chem. Phys.; 61: No. 6, 2483-2484(15 Sep 1974).

The assignment by Chrysochoos of the second band of the absorption spectra of Eu(III) in solvents to the presence of nonionized Eu–NO_3 and Eu–Cl species in equilibrium with the solvated species is refuted. Chrysochoos in a comment accepts the criticism as well founded but cites observations that indicate that the nature of these bands is not as simple as that proposed by Peacock. (JSR)

5617 INFLUENCE OF ELECTROLYTES AND SURFACTANTS ON EMULSION SEPARATION OF COLLOIDS. Skrylev, L. D.; Kosovskaya, Yu. P. J. Appl. Chem. USSR (Engl. Transl.); 47: No. 5, 1095-1097(May 1974).

Translated from Zh. Prikl. Khim.; 47: No. 5, 1069-1072(May 1974).

Electrolytes and surfactants have a significant influence on emulsion separation of colloids collected by synthetic surfactants of the cationic and anionic types. The electrolytes used were $Th(NO_3)_4$, $Al(NO_3)_3$, $Ba(NO_3)_2$, $NaNO_3$, KI, KBr, KCl, and KNO_3 and the surfactants were ethyl, n-butyl, and isoamyl alcohols and glycerol. The degree of emulsion separation of colloids increases with increase of the amount of electrolyte added to the sol, and generally passes through a maximum with increase of the amount of alcohol added. (JSR)

Isotope Effects

5618 (AED-CONF-74-183-003) VELOCITY AND ISOTOPE EFFECT OF THE REACTIONS OF THE OH-RADICAL WITH H_2, D_2, HCl, DCl, AS MEASURED BY TIME-RESOLVED RESONANCE ABSORPTION. Smith, I. W. M.; Zellner, R. (State Univ. of New York, Albany (USA). Dept. of Physics). 1974. 12p. (In German). INIS.

From 73rd general meeting of the Deutsche Bunsen-Gesellschaft fuer Physikalische Chemie e.V.; Kassel, F. R. Germany (23 May 1974).

8 figs.

By time-resolved resonance absorption the reactions of the OH radicals with the two-atomic species HX (X = halogen) and with the deuterated compound DX the kinetic isotope effect of the H-(D)-transfer reaction was studied. In the temperature region 220 to 480°K the reaction velocities of the OH radical with H_2, D_2, HCl, and DCl were measured directly. The observed isotope effect was estimated by means of the transition-state theory and semi-empirical potential equations. (GE)

5619 INDICES OF TRANSITION STATE SYMMETRY IN PROTON-TRANSFER REACTIONS. Kinetic Isotope Effects and Bronsted's β in Base-Catalyzed Diazo-Coupling Reactions. Hanna, S. B.; Jermini, C.; Loewenschuss, H.; Zollinger, H. (Swiss Federal Inst. of Tech., Zurich). J. Amer. Chem. Soc.; 96: No. 23, 7222-7228(13 Nov 1974).

The applicability of k_H/k_D and of Bonsted's β as indices of transition state symmetry in proton-transfer reactions has been tested in a number of base-catalyzed electrophilic aromatic substitution reactions. The data obtained from measurements involving the coupling of the diazonium salts of m- and p-chloroanilines, p-nitroaniline, and 4-amino-3-hydroxybenzenesulfonic acid with two naphthols and their deuterated analogs, catalyzed by 12 bases, provide ample evidence for doubting the validity of β as a measure of the degree of proton transfer at the transition state. Variations in the structure of the transition state, caused by changes in the pK_a of the catalyzing base, are more readily reflected in k_H/k_D. The origin of the observed variation of isotope effects is discussed, and the validity of k_H/k_D as an index of transition state symmetry is questioned. (auth)

5620 CYCLOOCTATETRAENE-BICYCLO[4.2.0]OCTATRIENE EQUILIBRIUM. A Striking Gradation in Secondary Deuterium Isotope Effects During Diels–Alder Reactions of Monosubstituted Derivatives. Paquette, L. A.; Kitching, W.; Heyd, W. E.; Meisinger, R. H. (Ohio State Univ., Columbus). J. Amer. Chem. Soc.; 96: No. 23, 7371-7372(13 Nov 1974).

Details are reported of a secondary deuterium isotope effect study which reveals for the first time that fractionation factors associated with adduct formation are highly sensitive to the nature of the ring substituent and dienophile. (LK)

5621 ASYMMETRIC INDUCTION BY ISOTOPIC DISSYMMETRY IN [$\alpha\alpha$-$^2H_2$]. Cinquini, M.; Colonna, S. (Consiglio Nazionale della Richerche, Milan, Italy). J. Chem. Soc., Chem. Commun.; No. 19, 769-770(9 Oct 1974).

Reaction of (R)-(+)-[$\alpha\alpha$-$^2H_2$] dibenzyl sulfoxide with $PhICl_2$ or bromine in pyridine to afford preferentially one of the four possible diastereoisomeric α-halogenosulfoxides is highly stereoselective; the corresponding α-halogenosulfones are optically active, thus indicating that asymmetric induction is operating. (auth)

5622 MILLIMETER- AND SUBMILLIMETER-WAVELENGTH SPECTRA AND MOLECULAR CONSTANTS OF HTO AND DTO. Helminger, P. (Duke Univ., Durham, NC); De Lucia, F. C.; Gordy, W.; Staats, P. A.; Morgan, H. W. Phys. Rev., A; 10: No. 4, 1072-1081(Oct 1974).

The rotational spectrum of DTO and HTO in the ground vibrational state has been measured with high-resolution microwave techniques in the 50 to 700-GHz region. Forty-one transitions of DTO were measured. Analysis of these data yielded the following rotation and distortion parameters of the Watson formulation (in MHz): A = 410,174.145 ± 0.078, B = 172,101.952 ± 0.045, C = 119,127.850 ± 0.045, Δ_J = 5.199034 ± 0.003, Δ_{JK} = −15.50411 ± 0.015, Δ_K = 180.31052 ± 0.010, δ_J = 1.941256 ± 0.0010, δ_K = 12.8893 ± 0.012. Twenty-two previously undetected transitions of HTO were measured. Analysis of these, together with 26 lines already known, gave the following rotation and distortion parameters (in MHz): A = 677,849.040 ± 0.170, B = 198,197.489 ± 0.128, C = 150,462.412 ± 0.128, Δ_J = 5.212023 ± 0.003, Δ_{JK} = 48.52276 ± 0.02, Δ_K = 271.27533 ± 0.06, δ_J = 1.414126 ± 0.0005, δ_K = 51.32833 ± 0.07. The usual distortion-free rotational constants derived from these Watson constants are (in MHz): for DTO, A′ = 410,160.3, B′ = 172,050.2, C′ = 119,183.6, and for HTO, A′ = 677,777.7, B′ = 198,089.7, C′ = 150,604.4. The latter constants and corresponding ones previously obtained for other isotopic species of water were used to calculate substitutional structures of the molecule. The averages of the structural parameters thus obtained are 0.9577 Å for the bond length and 104.66° for the bond angle. (auth)

5623 PARTITION FUNCTION RATIOS OF THE METHYL HALIDES DIFFERING ONLY IN ISOTOPIC SUBSTITUTION. Bron, J. (Univ. of Natal, Durban, S. Afr.). Can. J. Chem.; 52: No. 17, 3078-3082(1 Sep 1974).

By using the best available spectroscopic data for the force fields and geometries of the methyl halides, partition function ratios for these species are evaluated as a function of temperature. These ratios are of the types q(AXYZB)/q($^{12}CH_3B$) in which q is the partition function; A is ^{12}C, ^{13}C, or ^{14}C; X, Y, and Z are either ^1H, ^2H, or ^3H; and B stands for either F, Cl, Br, or I. To the logarithm of these functions at the various temperatures (200-500 K) a curve is fitted with the equation in $(q_2/q_1) = p_1 \ln (T/500) + \Sigma_{n=2} p_n (T/500)^{n-2}$. All ratios are determined with respect to the unsubstituted $^{12}CH_3B$ molecule. Examples of the utility of the partition function ratios are given. (auth)

Isotope Exchange and Isotope Separation

Refer also to abstract 5686.

5624 (UCRL-51681) SIMPLE MODEL OF D_2-DT-T_2 EQUILIBRIUM AT CRYOGENIC TEMPERATURES. Souers, P. C.; Hickman, R. G.; Wade, W. Z.; Tsugawa, R. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Oct 1974. Contract W-7405-Eng-48. 13p. Dep. NTIS $4.00.

The literature on cryogenic properties of mixtures of hydrogen isotopes is reviewed. Liquid solutions of H_2, HD, and D_2 appear totally miscible, but there is evidence of possible phase separation in the solid state. Using phase diagram data for H_2, DH, and D_2, estimates are made of the behavior of D_2-DT, $DT-T_2$, and D_2-T_2 mixtures at cryogenic temperatures. A complete phase diagram is assembled for the three-component DT system. Based on this diagrammatic model, a D/T ratio of 1.63 is required in the gas to yield a ratio of 1.00 upon liquefaction. Absence of reaction rate data makes it impossible to estimate the chemical stability of the isotopic species DT. Low-temperature gas chromatography is recommended as the best means of isotopic separation, should this be necessary. (auth)

5625 PHOTO-OXIDATION IN THE SYNTHESIS OF ^{17}O AND ^{18}O LABELLED COMPOUNDS. Synthesis of Xanthone-$^{18}O_1$. Pownall, H. J. (Baylor Univ., Houston, TX). J. Label. Compounds; 10: No. 3, 413-417(1974).

It is shown that the photo-oxidation of aromatic molecules containing an active methylene group can be used to introduce isotopic oxygen. Photo-oxidation of xanthene results in the formation of xanthone with the oxygen label appearing in the product at the carbonyl group. In this way, 100% enrichment can be realized. A brief discussion of other systems to which this method may be extended is also given. (auth)

5626 HETEROGENEOUS ISOTOPE EXCHANGE, CRYSTAL GROWTH AND DISSOLUTION OF IONIC CRYSTALS, AS SHOWN BY THE EXAMPLE OF LEAD SULFATE. Lang, G.; Lieser, K. H. (Technische Univ. Darmstadt (F. R. Germany). Fachbereich Anorganische Chemie und Kernchemie). Z. Phys. Chem. (Frankfurt); 86: No. 3-6, 143-155(Oct 1973). (In German).

5 figs.; 4 tabs.; 20 refs.

In a kinetic study heterogeneous isotopic exchange between $PbSO_4$ and $^{212}Pb^{2+}$ ions was investigated. Using the same crystals the crystal growth from supersaturated solutions was studied as well as the dissolution in water. In each case the surface reaction is rate determining. The activation energies of heterogeneous isotopic exchange $E = (4.1 \pm 0.4)$ kcal/mol and of dissolution $E = (3.9 \pm 0.2)$ kcal/mol are equal, whereas the activation energy of crystal growth $E = (1.25 \pm 0.47)$ kcal/mol is considerably smaller. Hence it follows that the rate determining step of the exchange reaction on the surface is the removal of the ions from their lattice position. (auth)

5627 SEPARATION OF LIGHT AND HEAVY HYDROGEN IN THE REACTION OF LITHIUM AMALGAM WITH WATER. Valfells, A.; Brinegar, D. (Iowa State Univ., Ames). Trans. Amer. Nucl. Soc.; 19: 70-71(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5628 LIQUID-LIQUID-EXTRACTION FOR THE ENRICHMENT OF STABLE BORON ISOTOPES. Gerstenberger, H. Isotopenpraxis; 10: No. 8, 285-289(Aug 1974). (In German).

Production of enriched boron isotopes is mainly achieved by exchange distillation of complex BF_3/BF_3 · ether compounds. Though possessing high simple process factors and favorable phase inversion reaction, this method nevertheless shows some disadvantages. Investigations have been made to find out, if liquid-liquid exchange with liquid anionites offers favorable possibilities of boron isotope enrichment. Systems of the amine/diluent//boric acid/tartaric acid/water type proved to be suitable for boric acid extraction. The mean value of the simple separation factor $\bar{\alpha}$ is 1.023 with regard to the investigated systems. The comparatively high simple separation factor results from the fact that in the aqueous phase boron is mainly trivalent, while in the organic phase it is quadrivalent. (auth)

5629 HYDROGEN-WATER DEUTERIUM EXCHANGE OVER UNSUPPORTED GROUP 8 NOBLE METALS. Sagert, N. H.; Pouteau, R. M. L. (Atomic Energy of Canada, Pinawa, Manitoba). Can. J. Chem.; 52: No. 16, 2960-2967(15 Aug 1974).

Specific activities of unsupported powders of all six Group VIII noble metals were determined for hydrogen-water deuterium isotope exchange. The metal surface areas, which are required to calculate the specific activities were measured by hydrogen chemisorption and checked by electron microscopy. Specific activities were measured as a function of temperature in the range 353 to 573°K and also as a function of the partial pressure of hydrogen and water at suitable temperatures and over a tenfold range of partial pressures. The variation in the specific activities was Pd < Ir ≤ Ru < Rh < Os < Pt, and these specific activities varied over a range of about 1000. The observed orders with respect to hydrogen and water are shown to be consistent with a mechanism in which chemisorbed hydrogen atoms exchange with physically adsorbed water. From the orders and the apparent activation energies, the chemical activation energies (E_0) were calculated. These varied randomly within the range 61 ± kJ mol^{-1} for all the metals studied. Previously it was shown that there was a correlation of E_0 with the work function of the metal when metals were supported on a highly graphitized carbon black, and suggested that electron donation from the carbon to the metal was responsible for the correlation. This suggestion is supported by the present results which show that E_0 is relatively constant for all six metals in the absence of a support. (auth)

5630 FRACTIONATION OF SELENIUM ISOTOPES BY THE YEAST CANDIDA TROPICALIS. Zyakun, A. M.; Reshetnikova, I. A.; Matrosov, A. G.; Eroshin, V. K. (Inst. of Biochemistry and Physiology of Microorganisms, Pushchino-on-Oka, USSR). Dokl. Biochem. (Engl. Transl.); 215: No. 1-6, 110-111(1974).

Translated from Dokl. Akad. Nauk. SSSR; 215: No. 2, 464-465 (Mar 1974).

An attempt was made to detect biological fractionation of selenium isotopes. Yeasts of the genus Candida, which are capable of reducing the selenite ion and accumulating selenium in the cells, were used in the experiments. Fractionation was judged by comparing the isotopic composition of selenium of the biomass of the organisms and the culture fluid remaining after culturing the yeasts. The measured coefficient of separation in the case of microbiological reduction of the selenite ion was 1.019, which is close to the value of the coefficient of separation calculated theoretically for the kinetic isotope effect of the reduction reaction $SeO_3^{2-} \rightarrow Se^0$ (1.017). (LK)

5631 APPARATUS FOR THE PRODUCTION OF HIGH ISOTOPIC PURITY DEUTERIUM. Persky, A.; Kuppermann, A. (California Inst. of Tech., Pasadena). J. Phys., E (London); 7: No. 11, 889-890(Nov 1974).

An apparatus for the electrolytic preparation of high purity D_2 is described. D_2 with isotopic purity exceeding 99.98% (atomic percentage) was obtained with this apparatus by electrolyzing D_2O (99.8% isotopic purity) down to about 30% of its original volume. (auth)

5632 1,3-BRIDGED AROMATIC SYSTEMS. XII. Hydrogen-Deuterium Exchange Reactions in 1-Substituted 12,13-Benzo-16-Chloro[10](2,4)Pyridinophanes. Parham, W. E.; Olson, P. E. (Duke Univ., Durham, NC). J. Org. Chem.; 39: No. 23, 3407-3410(15 Nov 1974).

Deuterium exchange reactions have been studied with a variety of syn- and anti-pyridinophanes of type 1 and 2, both in acetic acid-d_4 and in alcohol with added alkoxide or hydroxide. Deuterium exchange at the methine carbon in acetic acid-d_4 is highly specific for syn and anti acetates (1a and 2a) and for syn bromide 1b with retention of configuration; epimerization was observed for the anti bromide 2b. Exchange reactions in more basic media at the methine carbon are also stereospecific, with retention of configuration, with the exception of the anti bromide 2b which leads to some epimerization. Reaction of syn alcohol 1b, but not anti alcohol 2b, with ethoxide in ethanol results in appreciable dechlorination of aryl halide. (auth)

Feed Materials Processing

Refer also to abstract 6354.

Radiation Chemistry

Refer also to abstracts 5660, 6079, 6245, 6246, 6263, 6515, 6750, 6751, 6755, and 6944.

5633 (CEA-R-4614) APPLICATION OF THE DRIFT TIME METHOD TO THE STUDY OF EVOLUTION OF IONS OF RADIOCHEMICAL ORIGIN. Krien, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Protection). Oct 1974. 86p. (In French). Dep. NTIS (US Sales Only) $7.50.

Thesis. Submitted to Paris Univ. (France).

The variation of the mobility of ions created by α or β ionization was studied as a function of their contact time with filtered atmospheric air; it was shown that "small ions" (mobility over 1 $cm^2 \cdot V^{-1} \cdot sec^{-1}$) and "intermediate ions" (mobility under 1 $cm^2 \cdot V^{-1} \cdot$

sec^{-1}) followed the same variation laws. It was demonstrated experimentally that (1) the nature of the ionization source did not affect the formation of "intermediate ions," (2) observation of this class of ions was subject to the measurement technique used. It was finally demonstrated that the formation and evolution of "intermediate ions" required the presence of a nucleogenic impurity. (auth)

5634 (COO-3118-8) EFFECTS OF MERCAPTANS AND DISULFIDES ON PHOTOCHEMICAL AND HIGH ENERGY RADIATION INDUCED REACTIONS. Progress Report, November 1, 1973–October 31, 1974. Cohen, S. G. (Brandeis Univ., Waltham, Mass. (USA). Dept. of Chemistry). 1974. Contract AT(11-1)-3118. 61p. Dep. NTIS $6.25.

Products of ^{60}Co γ irradiation of dilute aqueous methyl acetate were studied. Reactions are interpreted in terms of formation of $CH_3\dot{C}(O^-)OCH_3$ I, $CH_3\dot{C}(OH)OCH_3$ II, $CH_3\dot{C}O$ IIA, $\cdot CH_2CO_2CH_3$ III and $CH_3CO_2\dot{C}H_2$ IV, and their combination, redox, and cleavage reactions. Radical combinations lead to ethylene diacetate IV-IV, methyl β-acetoxypropionate IV-III, dimethyl succinate III-III, methyl acetoacetate II-III or IIA-III, and acetonyl acetate II-IV or IIA-IV. Acetic acid is a major product, formed by oxidation of II or IIA and IV by III and H_2O_2. Mercaptan-thiyl reduce III and IV, oxidize II, regenerate methyl acetate by repair and prevent formation of coupling products. Mercaptan damages by reducing II to acetaldehyde and methanol. Other additives scavenge primary fragments, H^+, N_2O, H_2O_2 and $CH_3COCOCH_3$, remove e^-_{aq} and I^-, II, IIA; H^+ increases H and III; N_2O and H_2O_2 increase OH and IV. Photoreduction and quenching of fluorenone by ring substituted anilines and N-alkyl and N,N-dialkylanilines are interpreted in terms of initial rapid charge transfer interaction, followed by reduction or quenching. Linear free energy relationships are found between rates of interaction and σ^+ or ionization potential. Reduction quantum yields are decreased by excessive electron donation or withdrawal, by aromatic NH and by low basicity of the anionic part of the CT complex. (auth)

5635 (LF-46) PROTON HYPERFINE STRUCTURE IN THE ESR SPECTRUM OF THE ACETONITRILE DIMER RADICAL ANION. Gillbro, T.; Takeda, K.; Williams, F. (Forskningsraadens Lab., Studsvik (Sweden)). 1973. 19p. Dep. NTIS (U. S. Sales Only) $4.00.

The ESR spectrum of $(CH_3CN)_2^-$ has been observed in a γ-irradiated single crystal of acetonitrile at 77°K. At a crystal orientation for which the spectra from magnetically distinguishable sites coalesce, the spectrum consists of a well-resolved hyperfine structure arising from a ^{14}N quintet of ^1H septets, typical coupling constants being A (^{14}N) = 8.5 G and A (^1H) = 2.1 G. This well-resolved spectrum saturates readily with increasing microwave power and is photobleachable by red light, these effects paralleling those observed for the ^{14}N quintet spectrum of $(CD_3CN)_2^-$. The lack of spectral resolution at other orientations is attributable to interference by site splitting and to a decrease in the proton coupling as the nitrogen coupling increases to its maximum value in the rotation plane. Confirmation of the latter observation has been obtained by similar studies on CH_3DCN and CHD_2CN. Both the magnitude of the proton coupling and its relationship to the nitrogen coupling are shown to be consistent with information on the structure and spin density distribution derived from studies of the dimer radical anion in deuterated acetonitriles. (auth)

5636 (RISO-M-1719) RADIATION INDUCED CROSS-LINKING OF POLYETHYLENE. Handlos, V. N. (Danish Atomic Energy Commission, Risoe. Research Establishment). Jun 1974. 104p. (In Danish). Dep. NTIS (U. S. Sales Only) $8.25.

The experimental work was carried out by irradiating different low density polyethylene samples with electrons from a 10-MeV electron accelerator. The effect of different unsaturated monomers on the cross-linking reaction was also studied. The irradiated product was examined by determination of the soluble fraction in boiling xylene and by mechanical methods. Determination of the radiation chemical yield was first carried out according to the existing theories based on the gel-dose determination, but without success. The existing theories were expanded by using the molecular weight distribution of the polymers, determined by high-temperature gel permeation chromatography. By using this expanded theory it was possible to determine the radiation yield of cross-linking G(x) and chain scission G(s); G(x) varied from 1.0 to 2.7 and G(s) from 0 to 2.7 dependent on the polymer. The cross-linking model was further used on different polymer/monomer systems and it was shown that trimethyloipropantrimethacrylate could increase the cross-linking yield by a factor of 10 and diallylfumarate by a factor 5, for concentrations in the range of 2 to 4%. (auth)

5637 (TRITA-KKE-7401) REPORT ON THE RESEARCH AT THE DEPARTMENT OF NUCLEAR CHEMISTRY, ROYAL INSTITUTE OF TECHNOLOGY SPONSORED BY THE SWEDISH ATOMIC RESEARCH COUNCIL, 1973. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden). Institutionen foer Kaernkemi). 1973. 12p. (In Swedish). Dep. NTIS (US Sales Only) $4.00.

Research projects are heavy element analysis by neutron activation, development of instrumentation for detection and characterization of short lived radicals and radical ions in pulse radiolysis experiments, adaptation of an on-line mini computer to the pulse radiolysis detection system, transient spectra and kinetics of short lived intermediates in alkane radiolysis, gas sensitized radiolysis of thiol compounds, ionic fragmentation pattern for methanethiol, radiation chemistry of S(IV) compounds in aqueous solutions, radiation chemistry of sulphonic acids, and proton pulse radiolysis. (auth)

5638 RADIATION POLYMERIZATION OF N-4-CARBOXYPHENYLMALEIMIDE. Nazarov, A.; Zykova, S. K.; Ivanov, V. S. Vestn. Leningrad. Univ., Fiz., Khim.; No. 1, 155-156(Feb 1974). (In Russian).

N-4-carboxyphenylmaleimide has been polymerized in solution of acetic acid by γ-rays of ^{60}Co. The effect of dose and dose rate on polymerization process has been investigated. $G = 1{,}3 \cdot 10^5$ mol/100 ev at 85° C, 1 Mrad/hr, 4 Mrad and monomer concentration of 0,34 mol/1. The polymer has been characterized on solubility (in DMFA DMSO), intrinsic viscosity (0,22 dl/g), temperature of decomposition (380°C), ir spectra and x-ray diagram analyses. (auth)

5639 RADIATION POLYMERIZATION IN THE SOLID STATE. IV. Influence of the Oxygen on the Yield of Radiation Polymerization N-Vinylcarbazole. Pekala, W.; Lesinski, A. (Politechnika, Lodz, Poland). Nukleonika; 19: No. 9, 769-775(1974). (In Polish).

The conversion of crystalline N-vinylcarbazole (NVC) into polymer was investigated in the presence and absence of the air. The process was carried out using γ rays from ^{60}Co at 20 to 70°C. The presence of oxygen over the surface of the monomer crystal has no influence on the rate of polymerization in the temperature range from 20 to 40°C. At higher temperatures, atmospheric oxygen acts as a free radical inhibitor on the polymerization process of NVC in the solid and liquid state. (auth)

5640 PULSE RADIOLYSIS OF SELENIUM CONTAINING COMPOUNDS: SELENOMETHIONINE. Tamba, M.; Bonora, S.; Badiello, R. (Consiglio Nazionale delle Ricerche, Bologna (Italy) Lab. di Fotochimica e Radiazioni d'Alta Energia). Z. Naturforsch.; 29B: No. 7/8, 571-572(Jul 1974).

1 fig.; 11 refs.

The pulse radiolysis of aqueous solutions of selenomethionine was studied under both neutral and acid conditions and the transient optical absorption spectra were observed. The reactivities of both e^-(aq) and OH radicals were measured, as well as the formation and decay kinetics of the transient species. (auth)

5641 ISOMERIZATION OF $C_4H_9^+$ IONS IN THE RADIOLYSIS OF GASEOUS ETHYLENE. Gawlowski, Niedziekski, J. (Warsaw Univ. (Poland). Lab. of Radiochemistry and Radiation Chemistry). Ber. Bunsenges. Phys. Chem.; 78: No. 5, 489-492(May 1974).

6 figs.; 18 refs.

The reactions of butyl ions in ethylene irradiated with ^{60}Co γ rays in the gas phase were investigated using isopentane as a competitive reagent and ammonia as a proton scavenger. The presence of ions having a tertiary structure was established. The kinetic analysis of two independent sets of data gave, at 500 Torr, G = 0.185 and G = 0.20, respectively. Tert-$C_4H_9^+$ ions were found to be unreactive towards ethylene. The rate constant for this reaction was calculated to be 8×10^{-14} cm^3 $molecule^{-1}$ sec^{-1}. (auth)

5642 RADIATSIONNAYA FIZIKA I KHIMIYA POLIMEROV. (Radiation Physics and Chemistry of Polymers). Makhlis, F. A. Moscow; Atomizdat (1972). 326p. (In Russian).

55 refs.

Many questions related to equipment and interpretation of results of radiation chemical experiments on irradiated polymers are examined. Areas of use of polymers in atomic and cosmic technology, basic conditions of testing radiation stability of polymers with the simultaneous action of heat, vacuum, etc. are discussed. Radiation heating of polymers, determination of absorbed energy, and effects of crystallinity, physical state, mechanical tension, temperature, dose rate, type of radiation and of the surrounding medium, and other factors on change in structure and properties of polymers are considered. Physical and physicochemical methods used for studying radiation conversion to polymers are described, and reversible and nonreversible changes in polymer properties and postradiation effects are discussed. (tr-auth)

5643 ON THE INFLUENCE OF IRRADIATION ON THE SYNTHESIS OF DIAMOND FROM METHANE. Fedoseev, D. V.; Pirogova, G. N.; Varnin, V. P. (AN SSSR, Moscow. Inst. Fizicheskoj Khimii). Dokl. Akad. Nauk SSSR; 214: No. 3, 618-620 (21 Jan 1974). (In Russian).

For English translation see the journal Dokl. Phys. Chem.

The effect of electron and gamma irradiation of diamond powders used for seeding in synthesizing diamond from methane was studied. Fast electron irradiation was done with a 1.5-MeV electron accelerator. The gamma irradiation was done with a ^{60}Co source for 10 days at room temperature. Experiments were carried out at 950 and 1000°C and a total methane-hydrogen pressure of 0.35 mm Hg. At 1000°C the difference in productivity was much less. At 950°C the relative productivity of the irradiated powder averaged 5 times that of the initial, while at 1000°C the ratio was 1.6. No differences were observed between the effect of fast electrons and gamma rays. (tr-INIS)

5644 GAMMA-RAY INDUCED CONDUCTIVITY IN INSULATING POLYMERS. VII. Okamoto, S.; Furuta, J.; Hiraoka, E. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 53-55(1973).

The induced currents of polyethylene samples which were preirradiated with cobalt gamma-rays to various heavy doses are measured. The induced currents of them are nearly unchanged with doses below 10^5 rad of pre-irradiation, but they decrease with doses over the 10^5 rad. The cause of these decreases seemed to be independent of the generation of trans-vinylene unsaturation, oxidation reaction and the destruction of crystallinity in heavy irradiated polyethylene, which were measured by the infrared-absorption spectroscopy. (auth)

5645 PULSED RADIOLYSIS OF CONCENTRATED AQUEOUS SOLUTIONS OF NITRIC ACID. Pikaev, A. K.; Sibirskaya, G. K.; Shirshov, E. M.; Glazunov, P. Ya.; Spitsyn, V. I. (Inst. of Physical Chemistry, Moscow). Dokl. Biochem. (Engl. Transl.); 215: No. 1-3, 328-331(Mar 1974).

Translated from Dokl. Akad. Nauk SSSR; 215: No. 3, 645-648 (Mar 1974).

The kinetics of the disappearence of NO_3 in the pulse radiolysis of aqueous solutions of nitric acid were studied to determine the cause of contradictory results reported earlier by Daniels. He observed that at low concentrations of acid, NO_3 disappearance takes place in a first-place reaction, and at high concentrations in a second-order reaction. At intermediate concentrations the process has mixed first and second orders. Results of the study show that the dependence of the rate of disappearance of NO_3 on its initial concentration explains the contradiction of the previous results. (LK)

5646 MECHANISM FOR THE RADIOLYSIS OF BENZYL-β-D GLUCOSIDE. Nikitin, I. V.; Miroshnichenko, I. V.; Nedoborova, L. I.; Kudryashov, L. I.; Kochetkov, N. K. (Inst. of Organic Chemistry, Moscow). Dokl. Biochem. (Engl. Transl.); 215: No. 1-3, 246-249(Mar 1974).

Translated from Dokl Akad. Nauk SSSR; 215: No. 1, 140-143 (Mar 1974).

An EPR study was made of γ-irradiated polycrystalline samples of β-phenyl and β-benzyl glucosides. Irradiation of benzyl-β-D-glucoside in the presence of a methylene group prevents the transfer of energy from the carbohydrate half of the molecules to the aromatic half as a result of which both carbohydrate and aromatic radicals are formed; that is, the aromatic aglycone does not protect the sugar from the γ radiation. In frozen aqueous solutions, primary radicals predominate which are the products from the addition of OH to the aromatic ring. (LK)

5647 RADIATION EFFECTS IN OXYGENATED FROZEN AQUEOUS ALKALI HYDROXIDE SYSTEMS. Moorthy, P. N.; Rao, K. N.; Mishra, K. P.; Singh, B. B. (Bhabha Atomic Research Centre, Bombay). Radiat. Eff.; 22: No. 4, 243-252(1974).

In the investigation of γ-irradiated frozen alkali hydroxides by ESR, several species, other than O^-, OH and e_t have been observed in the presence of O_2. The trapped electron signal observed (e_t^-) at 77°K in presence of N_2 becomes reduced in presence of O_2 on warming to 110°K or photobleaching and gives rise to a new species (I). Some brands of NaOH and KOH give a hyperfine structure after irradiating at 77°K and warming to 178°K called species (III). In presence of air only a broad singlet is observed. With super pure NaOH and some other brands of alkali only the broad singlet is seen which becomes intense in presence of O_2 and is called species (II). The hyperfine structure III which had been previously attributed to agglomeration of alkali atoms, has been shown to be only due to impurities in some alkali hydroxides. Species (I) has been shown to be O_3^-. From studies using electron scavengers, and the experiments with different alkali hydroxides with and without NaCl and studies with H_2O and D_2O, the broad singlet (II) observed in presence of O_2 could not be identified with either alkali atoms or O_3^- hence it is suggested that the new species in either O_3^{3-} formed from $O^{2-} + O_3^- \rightarrow O_3^{3-}$ or a complex of $O^{2-} \ldots O_2^-$. (auth)

5648 TUNNELLING MAGNETIC RESONANCES. Clough, S.; Hobson, T. (Nottingham Univ., Eng.). J. Phys., C (London); 7: No. 18, 3387-3402(21 Sep 1974).

Lineshape studies identify the processes responsible for two resonant features in the low-temperature magnetic-field dependence of the recovery of proton magnetization following saturation in γ-irradiated 4-methyl-2,6-ditertiarybutylphenol. One of the lines occurring at a field of 0.33 T exhibits "hole burning" and other effects associated with inhomogeneously broadened lines and may be inverted. By contrast, the other at 0.15 T has always the same shape. The resonances are both due to processes which involve spin symmetry conversion of a methyl group with simultaneous flips of both nuclear and electronic spins, but they differ in that the 0.15 T resonance involves methyl groups strongly coupled by the hyperfine interaction with the unpaired electron spins while the 0.33 T resonance is due to the relatively weakly dipole-dipole coupled methyl groups fairly remote from the unpaired electron. The remarkable memory effects exhibited by this resonance are due to concentration gradients of methyl group spin species in the vicinity of paramagnetic centers. The concentration gradients depend in a predictable way on the history of magnetic-field variation while the sample is held at low temperature. The lifetime of the methyl group spin species at 4.2°K is many hours. (auth)

5649 OPTICAL AND ESR STUDIES IN N-ACETYL DL-METHIONINE SINGLE CRYSTALS γ-IRRADIATED AT LOW TEMPERATURE. Kawatsura, K. (Japan Atomic Energy Research Inst., Tokai); Ozawa, K.; Kominami, S.; Akasaka, K.; Hatano, H. Radiat. Eff.; 22: No. 4, 267-275(1974).

N-acetyl DL-methionine single crystals are irradiated with ^{60}Co γ-rays or x-rays at liquid nitrogen temperature and liquid helium temperature in the dark. The radical cations produced by irradiation are investigated using optical absorption spectrum and esr. On irradiation, the observable product is the β radical, the radical cation with a hole in a nonbonding orbital of the sulfur atom, which has three bands, i.e., b_1 (730 nm), b_2 (350 nm) and c (450 nm) bands. By annealing and photoillumination experiments, the β radical is transformed to the other isomers β* and β**, slightly different in the electronic structure and conformation, which have b_1^* (630 nm), b_2^* (330 nm) and b_1^{**} (570 nm), b_2^{**} (300 nm), respectively. In addition, photoinduced hole transfer β to β' (the hole in a π-orbital of carboxyl group) and the reverse process by thermal annealing were observed using optical absorption as well as esr. It is also observed that the β radical decays when photoilluminated in the b_1 or b_2 band and that the reaction proceeds in first order with respect to the concentration of reactants. Finally, it is found that two peaks of thermoluminescence correspond to the decay of cationic radicals, β and β*, respectively. (auth)

5650 METHYL GROUP TUNNELLING FREQUENCY MEASUREMENT BY ELECTRON NUCLEAR DOUBLE RESONANCE IN A POWDER. Clough, S.; Hill, J. R.; Punkkinen, M. (Nottingham Univ., Eng.). J. Phys., C (London); 7: No. 18, 3413-3417(21 Sep 1974).

The frequency of tunnelling rotation of methyl groups in free radicals in γ-irradiated single crystals has been previously obtained from small second-order shifts of the frequencies of electron nuclear double resonance lines. This technique is here extended to powders. Though the powder average gives rise to a line whose overall width greatly exceeds the shift to be measured, the lineshape exhibits a well defined edge on account of the axial symmetry of the hyperfine coupling tensor and this permits the shift to be measured with only marginally less accuracy than in a single crystal. Measurements are described on irradiated powdered samples of magnesium lactate for which the tunnelling frequency (the energy splitting of the ground molecular state divided by h) is found to be 1900 ± 300 MHz. (auth)

5651 ^{60}Co-GAMMA RADIOLYSIS OF CYSTEINE IN AERATED SOLUTIONS AT pH 5.5 TO 6.0. Lal, M. (Bhabha Atomic Research Centre, Bombay). Radiat. Eff.; 22: No. 4, 237-242(1974).

In the γ-radiolysis of cysteine (CySH) in aerated solutions in the pH range of 5.5 to 6.0, the G-values of the radiolytic products, cystine (CyS-SCy), cysteine sulfinic acid ($CySO_2H$), serine (CyOH), alanine (CyH), lanthionine (CySCy), hydrogen peroxide and G(- CySH) have been determined. The results demonstrate good material balance for the radiolytic amino products. The G(CyOH) = 1.9, G(CyH) = 0.3 and G(CySCy) = 0.2, (all possessing a Cy unit) at 10^{-2} M cysteine concentration in aerated solutions suggest that most of the primary hydrated electrons (e_{aq}^-) react with cysteine to give Cy radicals which give rise to CyO_2 radical in presence of oxygen. CyO_2 further reacts with cysteine to give serine and lanthionine. Electron scavengers like NO_3^- and acetone have been found to re-

duce the yields of serine, alanine and lanthionine. These competition experiments further strengthen the conclusion that CyO_2 radical is the precursor for serine and lanthionine. Based upon the mechanism suggested in the paper, a rate expression for G(- CySH) has been evaluated. The results of the dose rate experiments suggest a radical-radical chain termination step. (auth)

5652 CHEMICAL EFFECTS OF RADIATION ON PLASTICS AND PHARMACEUTICALS. Gopal, N. G. S.; Rajagopalan, S.; Sharma, G. (Bhabha Atomic Research Centre, Bombay (India). ISOMED). pp 105-147 of Radiation Sterilization of Medical Products. Report on the Colloquium Held at Bhabha Atomic Research Centre on August 17-18, 1973. Bombay; Bhabha Atomic Research Centre (1973).

From colloquium on radiation sterilization of medical products; Bombay, India (17 Aug 1973). 6 figs.; 34 refs.

Chemical effects of radiation on plastics and pharmaceuticals were studied under four broad categories i.e. polymeric material, aqueous solutions, suspensions of drugs in solid state, and ointments. These studies point out that the interaction of radiation cannot be without some degree of chemical change. In the case of plastics, the changes observed are not significant at the sterilization dose. Cellulosic materials withstand 2.5 Mrad, while aqueous solutions show a varied behavior and saline solutions can be sterilized in polyethylene bottles. Aqueous dextrose solution, with suitable additions, can be made safe for radiation sterilization. Their physico-chemical properties are superior to the properties of the irradiated solutions of dextrose alone. Solids are found to be more stable to radiation than solutions. Irradiated hydrocortisone acetate and sulphacetamide sodium have been shown to conform to pharmacopoeial specifications. (INIS)

5653 CHARGE TRANSFER REACTION BETWEEN OXYGEN AND H^- FROM WATER. Gupta, S. K.; Melton, C. E. (Univ. of Georgia, Athens). J. Chem. Phys.; 61: No. 6, 2480(15 Sep 1974).

The transfer of charge from H^- (formed in water by ionizing radiation) to O_2 was studied in the region of 0 to 4 eV translational energy for the $H^- + O_2 \rightarrow H + O_2^-$ system by carrying out experiments at low oxygen pressure and correction for the charge transfer from O^- to O_2. The graphically shown results give a reaction threshold of -0.30 V. The reaction in endothermic by 0.294 eV. Since the reaction threshold is higher than calculations predict, it is assumed that only about 30% of the H^- translational energy is transferred to the electron during the charge transfer process. (JSR)

5654 STEROL METABOLISM. XXXII. Radioinduced Oxidation of Isomeric Cholesten-3β-ols. Kulig, M. J.; Smith, L. L. (Univ. of Texas, Galveston). J. Org. Chem.; 39: No. 23, 3398-3402(15 Nov 1974).

The air oxidation induced by ^{60}Co γ radiation of cholest-4-en-3β-ol, 5α-cholest-6-en-3β-ol, and 5α-cholest-7-en-3β-ol yielded allylic hydroperoxides and other oxidized derivatives. The Δ^4-sterol gave cholest-4-en-3-one, 6β-hydroperoxycholest-4-en-3-one, 3β-hydroxycholest-4-ene 6α-hydroperoxide, and cholest-4-ene-3β,6α-diol. The Δ^6-sterol gave cholesterol 7α- and 7β-hydroperoxides, the epimeric cholest-5-ene-3β,7-diols, 3β-hydroxycholest-5-en-7-one, and 5α-cholest-6-enc-3β,5-diol but no 3β-hydroxy-5α-cholest-6-ene-5-hydroperoxide. The Δ^7-sterol gave the epimeric 3β-hydroxy-5α-cholest-7-ene 6-hydroperoxides, the epimeric 5α-cholest-7-ene-3β,6-diols, 3β-hydroxy-5α-cholest-7-en-6-one, and cholesta-5,7-dien-3β-ol. Pyrolysis of either Δ^7-6-hydroperoxide gave the corresponding 5α-cholest-7-ene-3β,6-diol, 3β-hydroxy-5α-cholest-7-en-6-one, and cholesta-5,7-dien-3β-ol. Reaction pathways for oxidations by radiation-induced processes of the isomeric Δ^4-, Δ^5-, Δ^6-, and Δ^7-sterols and for their photosensitized oxidations in which singlet molecular oxygen is implicated were compared. (auth)

5655 RELATION BETWEEN ESR CENTERS AND CHEMICAL STABILITY OF GLASSES. Vargin, V. V.; Zakrevskii, V. A.; Ivanov, V. A.; Yudin, D. M. J. Appl. Chem. USSR (Engl. Transl.); 47: No. 5, 1022-1026(May 1974).

Translated from Zh. Prikl. Khim.; 47: No. 5, 992-997(May 1974).

The weakest bonds are broken by crushing, irradiation, and action of reagents; despite the different natures of the destructive agents, similar bonds (double oxygen bridges, -O-O-) are broken in a number of cases. The transition from presence to absence of phase separation on electron micrographs shows no correlation with variations of the ESR spectra and of the chemical stability of glasses. Only analysis of the fine structure of the electron micrographs reveals a connection. Microphase separation, in the form of globular packing of the chemically unstable phase embedded in the stable component, ensures formation of stable radicals during destruction of the glasses. The labile radicals formed may facilitate, through interaction bonds, joint dissolution of other glass components by the reagent. It is shown that ESR spectroscopy is a promising method for studying various aspects of the chemical stability of glasses. (auth)

5656 OXIDATION-REDUCTION PROPERTIES OF THE BELOKURIKH HEALTH RESORT WATER. Pokrovskaya, O. G.; Zhernosek, G. G. Vop. Kurortol., Fizioter. Lech. Fiz. Kul't.; 38: 178-179(1973). (In Russian).

The radon water of the resort was shown to have the same oxidation-reduction properties after removal of the radon as before. The data obtained confirm the presence in the water of radicals stabilized by the ions present. (MG)

5657 PULSE RADIOLYSIS STUDIES: MEASURED LIFETIMES OF SOME EXCITED MOLECULES IN THE NANOSECOND REGION. Carr, T. W. Troy, NY; Rensselaer Polytechnic Inst. (1974). 175p. University Microfilms Order No. 74-26,065.

Thesis (Ph. D.).

This research work is concerned with the study of the pulse radiolysis of gases and involves the direct determination of the short-lived species having lifetimes on the order of nanoseconds and longer. This study is most important in the determination of mechanisms and kinetics in radiation chemistry. At present, and in general, mechanisms of reactions in radiation chemistry are determined from the ratio of products, and the precursors leading to the final products are speculated upon. The existence of many precursors has not been directly determined. The technique of pulse radiolysis was applied to pure nitrogen, helium-nitrogen, and argon-nitrogen gaseous systems. The gas mixtures were studied at pressures ranging from 22 atmospheres to 50 Torr. The samples were irradiated with electron pulses from a 1 MeV Van de Graaff Accelerator at a pulse repetition rate of 100 pulses per second with an average current of 0.4 amperes. The electron pulses used were 1, 3, 10, 30, and 100 nanoseconds in width. The transient species formed were identified from their emission spectra and their reactivity was determined by use of a fast risetime photomultiplier and oscilloscope. The major emission systems studied were the N_2 second positive, the N_2^+ first negative, and the $OH(A^2\Sigma^+)$. Several impurity emission systems were also observed, such as the CN violet, CO^+, and Hg 2537Å. These impurity emissions were not studied in detail. The second positive state of nitrogen was formed by direct excitation in pure nitrogen and helium-nitrogen mixtures. However, in argon-nitrogen mixtures the second positive state of nitrogen is formed by an energy exchange mechanism involving the resonance levels of argon and the ground state of nitrogen: $Ar\ (^3P) + N_2\ (X'\Sigma^+) \rightarrow N_2\ (C^3\pi) + Ar\ (^1S)$. The N_2^+ first negative band system was not observed in pure nitrogen or argon-nitrogen mixtures. However, it was observed in mixtures of He + 0.1% N_2. The first negative state of N_2^+ is formed in helium by energy exchange or charge transfer: $He\ (2^3S) + N_2\ (X'\Sigma^+) \rightarrow N_2^+\ (B^2\Sigma^+) + He\ (^1S)$ or $He_2^+ + N_2\ (X'\Sigma^+) \rightarrow N_2^+\ (B^2\Sigma^+) + 2He$ or $He^+ + N_2\ (X'\Sigma^+) \rightarrow N_2^+\ (B^2\Sigma^+) + He$. The 3064 Å emission system of $OH(A^2\Sigma^+)$ was observed in mixtures of Ar + 0.5% N_2. This emission system arises from a trace amount of water as an impurity in the mixture. The $OH(A^2\Sigma^+)$ state is formed by both the direct excitation of the water and an energy exchange from the resonance level of argon to the water. The radiative lifetime of the emission bands of the $N_2\ C^3\text{-}\Pi\mu \rightarrow B^3\Pi\ g$ system in pure nitrogen and helium-nitrogen was found to be 41×10^{-9} sec. The radiative lifetime of the OH $(A^2\Sigma^+)$ state was found to be 1.04×10^{-7} seconds. (Diss. Abstr. Int., B)

Radiochemistry and Nuclear Chemistry

Refer also to abstracts 5637, 7358, and 7380.

5658 PRODUCTION OF ^{36}Cl-LABELED POLYCHLORINATED BIPHENYLS BY NEUTRON ACTIVATION: A REEEVALUATION. Greenwald, L.; Carey, W. E. (Ohio State Univ., Columbus). J. Ass. Offic. Anal. Chem.; 57: No. 6, 1397-1398(Nov 1974).

One attempt to prepare radiolabeled Aroclors (commercial mixtures of polychlorinated biphenyls (PCBs)) has involved neutron irradiation to produce ^{36}Cl-PCBs from ^{35}Cl-PCBs via an (n,γ) reaction. However, because of the long half life of ^{36}Cl, the (n,p) reaction forming ^{36}S from ^{35}Cl would predominate, leading to the production of between 5000 and 10,000 times as much ^{35}S-substituted PCBs as ^{36}Cl-PCBs. Also, significant amounts of ^{32}P would be produced. Therefore, it is shown that ^{36}Cl-PCBs cannot be produced from ^{35}Cl-PCBs without the concomitant interference of ^{35}S-substituted PCBs. (auth)

Hot-Atom Chemistry

5659 (JINR-P6-8103) CHEMICAL BEHAVIOR OF THE Zr AND Y RADIOACTIVE ATOMS FORMED BY IRRADIATING SOME FLUORINATED BETA-DIKETONATES WITH 660 MeV PROTONS. Zaitseva, N. G.; Islamova, Kh. M.; Nguyen Huynh Mai. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The chemical behavior of ^{88}Zr and ^{87m}Y atoms formed in zirconium and yttrium beta-diketonates irradiated with high energy protons has been studied using liquid chromatography and vacuum sublimation. It is shown that the yield of the different chemical forms depends on the type of beta-diketonate, on the presence of tributylphosphate (TBP) as organophosphorus down in the solution, and on the aggregate state of the chelates by the irradiation. The results obtained confirm the great importance of thermal reactions of "hot" atoms. (auth)

5660 HOT-ATOM CHEMISTRY OF SOLUTION-SOLID MIXTURES AND FROZEN SOLUTIONS OF TRIS(ACETYLACETONATO)COBALT(III). Tominaga, Takeshi (Tokyo Univ. (Japan). Faculty of Science). Radioisotopes (Tokyo); 22: No. 8, 411-414 (Aug 1973).

The mixtures of the saturated benzene (or acetic acid) solution and solid of $Co(acac)_3$ were irradiated with thermal neutrons and the ^{60}Co retention in the mixtures was determined. The ^{60}Co retention in the $Co(acac)_3$-acetic acid systems was found to agree with the theoretical value estimated by using the ^{60}Co retention in the solution and solid phase. The ^{60}Co retention in the frozen acetic acid solutions of $Co(acac)_3$ at various concentrations was also investigated as similar heterogeneous systems. (auth)

Properties of Radioactive Materials

Refer also to abstracts 5566, 5603, 6388, 6389, and 6393.

5661 (BARC-757) MICRO-SECOND FLASH PHOTOLYSIS APPARATUS FOR ACTINIDE TRANSIENT CHEMISTRY. Bhattacharyya, P. K.; Saini, R. D. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.). 1974. 49p. Dep. NTIS (US Sales Only) $5.50.

A flash photolysis apparatus was designed and fabricated to study the transient chemistry of actinide ions in solution. The coaxial flash lamp with built-in solution cell of 30 cm length was constructed. A continuous source of analyzing light was made by using high pressure xenon arc lamp. The flash characteristics were investigated and suitable parameters are determined to obtain 25 μsec flash duration at an electrical energy of ~1500 J. The actinometric study using potassium ferrioxalate shows that the energy of the order of 10^{19} quanta is absorbed in solution per flash. A remote control system was designed to deaerate radioactive solutions conveniently inside the glove box and to introduce the deaerated solutions into the cell for flash photolysis. The performance of the apparatus was evaluated by investigating the spectrum of Cl_2^- transient in HCl medium. The rate of disproportion of Cl_2^- and its possible reaction with H atom were investigated. (auth)

5662 (CONF-740561-1) VIBRATIONAL ANALYSIS OF THE URANIUM HEXACHLORIDE SPECIES IN OXIDATION STATES OF IV, V AND VI. Shamir, J.; Silberstein, A.; Ferraro, J. R.; Choca, M. (Argonne National Lab., Ill. (USA)). 1974. 13p. Dep. NTIS. $4.00.

From vibrational spectroscopy symposium; Argonne, Illinois, USA (17 May 1974).

The infrared and Raman data for the uranium hexachlorides (UCl_6, UCl_6^-, and UCl_6^{--}) are reported. The vibrational frequencies are assigned on the basis of an O_h point group symmetry, and using the Modified Urey-Bradley Force Field (MUBFF) and the Molecular Orbital Valence Force Field (MOVFF), a Normal Coordinate Treatment (NCT) was made. The trend of frequencies with oxidation state and counter ion, and the primary stretching force constant (K) variation with oxidation state and non-bonding valence electrons is discussed. (auth)

5663 (JUL-1076-NC) CHROMATOGRAPHY OF CARRIER-FREE INORGANIC FORMS OF ^{123}I AND ^{211}At AND ITS APPLICATION TO THE HALOGENATION OF URACIL AND DESOXYURIDINE. Meyer, G. J. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Nuklearchemie). Jun 1974. 67p. (In German). Dep. NTIS (US Sales Only) $6.50.

The radiohalogenides ^{123}I and ^{211}At were produced by the nuclear reactions ^{127}I(d,6n) ^{123}Xe(EC,β^+) ^{123}I and ^{209}Bi(α,2n) ^{211}At in the cyclotron. These isotopes were then used to prepare the carrier-free inorganic iodine and astatine species $^{123}I^-$, ^{123}ICl, $^{123}ICl_2^-$, $^{211}At^-$, $^{211}At^0$, $^{211}At^+$, $^{211}AtCl$, and $^{211}AtCl_2^-$. These species were identified by high-pressure liquid chromatography and separated in pure form. After the preparation and chromatographic purification, the radiochemical yields were 90% for the iodine species and between 60 and 70% for the astartine species. The characteristic behavior of the carrier-free inorganic halogen forms, especially the change of their oxidation states in chromatographic columns, was systematically studied. The formation of $^{123}I^-$, $^{211}At^-$, and $^{211}At^+$ was determined as a function of the concentration of the reducing or oxidizing additions to the eluent. It could be shown that a quantitative separation of $^{123}I^-$ and $^{211}At^-$ on Aminex A27 ion exchange columns could be obtained only by the addition of at least 10^{-2} or 10^{-1} mol/l of Na_2SO_3 to the eluent. The cation $^{211}At^+$ in 1 N HNO_3 can be quantitatively chromatographed on Aminex A7 ion exchange columns even with additions of 10^{-3} mol/l of $Cr_2O_7^{--}$. From the dependence of the yield of $Cr_2O_7^{--}$ states, the oxidation potential of the reaction $^{211}At^0 \rightarrow {}^{211}At^+ + e^-$ was determined as 1.09 V. Suitable inorganic forms of ^{123}I were used for the carrier-free iodination of uracil and 2'-desoxyuridin by classical methods. The identification and separation of the reaction products were made by a sequence determination of homologous compounds using high pressure liquid chromatography. In the iodination of desoxyuridin in nitric acid solution, carrier-free 5-^{123}I-2'-desoxyuridin could be obtained with yields between 40 and 50%. Electrohalogenation could be used with success for the preparation of carrier-free ^{123}I-uracil derivatives. After an optimization of the limited experimental possibilities with use of carrier-free quantities, up to 45% of carrier-free 5-^{123}I-2'-desoxyuridin could be obtained in 0.5 N HNO_3 at an anode potential of E_0 = 1.65 V. For the preparation of carrier-free 5-^{123}I-uracil, the reaction of 5-Li-uracil with carrier-free ^{123}ICl in tetrahydrofuran was especially suitable with radiochemical yields of 60%. All attempts to use these methods also for the astatination of uracil and 2'-desoxyuridin failed. Only astatine benzene could be detected from the reaction of lithium benzene with ^{211}AtCl in tetrahydrofuran with 12% yield. A comparison of the results of different halogenation reactions with consideration of the electron structure of the uracil system led to the conclusion that on these strongly deactivated aromatics a preceding addition reaction on the 5–6 double bond is more probable than a direct electrophilic reaction in the 5 position. The potential electrophilic At forms $^{211}At^+$ and $^{211}AtCl$ are clearly not in position to astatinate strongly deactivated aromatic systems such as uracil derivatives. (tr-auth)

5664 (KFK-1987) INVESTIGATIONS ON THERMODYNAMICS OF COUPLED REDUCTIONS. Schmidt, N. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Radiochemie). Jul 1974. 122p. (In German). Dep. NTIS (US Sales Only) $9.25.

Thesis. Submitted to Karlsruhe Univ. (West Germany). Fakultaet fuer Chemie.

A detailed survey is made of the theory of galvanic cells (first and second order), incorporating oxide and halide solid electrolytes. The conduction of electricity by the migration of ions and electrons in the mixed oxide ceramics ZrO_2(+CaO) and ThO_2 ($+Y_2O_3$) and in CaF_2 is considered. Other possible sources of errors in connection with EMF-measurements are discussed. The properties of a compound to be used as an auxiliary electrolyte in a galvanic cell are stated. It is shown that UO_2 can be used as an auxiliary electrolyte in the temperature-range of 800 to 1500°C and oxygen partial pressures within the limits of 10^{-30} to 10^{-15} atm. UF_3 is unsuitable for measurements of the molar free enthalpy of the solution of uranium in MeU_x (Me = Pd, Pt, Rh, Ir; $0 < x < 0,33$). By using a newly developed technique the oxygen partial pressure could be measured continuously during the whole coupled reduction. Thermodynamic values of the binary systems U–Me (Me = Pd, Pt, Rh, Ir) were determined. From the behavior of the molar free solution-enthalpy of the dissolution of uranium in MeU_x with changing temperature T and composition x the molar free enthalpy of formation of the intermetallic compounds Pt_5U and Pt_3U (800–1200°C), Pt_2U (1200–1400°C), $Pd_{11}U_2$ (800°C), Pd_5U and Pd_4U (1200°C), Rh_3U and Ir_3U (800–1500°C) are calculated. The limits of the use of coupled reduction for preparation of intermetallic phases have been determined and the molar free enthalpies of formation of nearly all intermetallic compounds prepared by coupled reduction have been estimated. Measurements and calculations are in excellent agreement with the "Engel-Brewer-theory of intermetallic compounds." (auth)

5665 (MLM-2176) POTENTIAL-pH DIAGRAMS AND PLUTONIUM. Silver, G. L. (Mound Lab., Miamisburg, Ohio (USA)). 1 Dec 1974. Contract AT-33-1-GEN-53. 23p. Dep. NTIS $4.25.

The concept of the greatest lower bound may be combined with conditions for the predominance of valence states to prepare potential-pH and other types of predominance region diagrams. The technique is illustrated for the case of plutonium together with a discussion of the representation of chemical elements and reactions by polynomial equations. (auth)

5666 (ORNL-tr-2844) KINETICS OF TYPICAL HYDROLYSIS REACTIONS OF MULTIVALENT CATIONS. Wendt, H.

Translated by R. G. Mansfield from Chimia (Aarau); 27: No. 11, 575-588(Nov 1973). 23p. Dep. NTIS $4.25.

This review summarizes kinetic investigations concerning the homogeneous hydrolysis reactions of multivalent metal cations in aqueous solution. Three main types of reactions are discussed: (a) Protolysis of aquated cations to form mononuclear metal-hydroxo-complexes. (b) The formation and fission of binuclear μ-hydroxo-bridged or μ-oxo-bridged metal hydroxo complexes. (c) The formation and acid degradation reactions of higher polynuclear metal hydroxo complexes. Whereas the protolysis reaction of aquo-metal cations is a simple and fundamental (acid-dissociation) reaction the formation of the binuclear complexes resembles in most cases closely the metal-anion-complex formation. The formation and degradation of the higher metal hydroxo complexes, however, mostly proceeds in two or more parallel reaction paths. Both the successive addition of mononuclear metal-hydroxo-species to metal hydroxo complexes of lower molecular weight as well as the initial formation of discrete sub-complexes which finally combine to the stable complex are observed for the formation reaction. An abstract of the paper from the original language appeared as NSA 29: 12630. (auth)

5667 PREPARATION OF FLUOTHANE-^{82}Br BY MEANS OF RECOIL LABELLING. Hoizumi, K.; Mogi, T.; Kudo, H. (Japan Atomic Energy Research Inst., Tokai). J. Label. Compounds; 10: No. 3, 437-449(1974).

Fluothane (1,1,1-trifluoro-2-chloro-2-bromoethane) is a well known anesthetic, and its labelled compound has been much required for the biological investigation. The method was studied to prepare fluothane-^{82}Br by means of recoil labelling. More than 20 organic species labelled with bromine-82 evolved in neutron-irradiated fluothane. From such a complicated system, however, fluothane-^{82}Br was purely obtained by the gas chromatographic separation. Under the optimum conditions, the radiochemical yield of fluothane-^{82}Br contributed to 38%. When 200 μl of the target material was irradiated with neutrons to the total neutron dose (nvt) of 3.4×10^{16}n/cm^2, the radioactivity of ^{82}Br-labelled fluothane isolated almost quantitatively was about 2.7 mCi. (auth)

5668 MAGNETIC ANISOTROPY OF CESIUM HEXACHLOROURANATE(IV). Figgis, B. N. (Univ. of Western Australia, Nedlands); Mackey, D. J. Aust. J. Chem.; 27: No. 9, 2053-2055 (Sep 1974).

The magnetic susceptibility and anisotropy of the hexagonal salt Cs_2UCl_6 were measured from 80 to 300°K and found to be essentially independent of temperature. The results were interpreted using a parameterized crystal field model. κ was found to be 0 · 93, but the $<C_3$-U-Cl deduced does not agree with the value known from the structure for any reasonable range of the crystal field parameter ρ_3. It is deduced that the next state, $\Gamma_4(O_h)$, above the ground Γ_1 state should be split by 50 cm^{-1}. This is in fair agreement with the value observed from the spectrum, 82 cm^{-1}. (auth)

5669 PILOT PLANT FOR THE TRANSFER OF UF_6. Esteban Duque, A.; Gispert Benach, G. Energ. Nucl. (Madrid); 19: No. 88, 69-75(1974). (In Spanish).

In order to acquire experience in the handling of UF_6 and to dispose of the U used in the development of various techniques and methods currently being studied in the substitution of natural U, a transfer pilot plant was developed for tanks of 14 tons. The characteristics of this installation and the safety and operational standards adopted are described. A transfer operation was described. (tr-auth)

5670 X-RAY STUDIES OF THORIUM COMPOUNDS AND STRUCTURE OF THE GUANIDINE ION. Nefedov, V. I.; Molodkin, A. K.; Salyn, Ya. V.; Ivanova, O. M.; Porai-Koshits, M. A.; Balakaeva, T. A.; Belyakova, Z. V. (Inst. of General and Inorganic Chemistry, Moscow). Zh. Neorg. Khim.; 19: No. 10, 2628-2631 (Oct 1974). (In Russian).

X-ray studies were made of the Th $5d_5$ line and the lines of the atoms of the ligands Cl 2p, BR 3d, and Ni 1s in 40 different thorium compounds. The capability of the acido-ligands to draw off the electron density from the thorium atoms in compounds of the type $ThX_n \cdot mH_2O$, where X is the acido-ligand, is NO_3^-, $F^- > C_2O_4^{2-} > PO_4^{3-} > CH_3COO^- > Cl^- > O^{2-}$. Regardless of the type of compound and the coordination number of the thorium, the NO_3^- anion attracts the electron density most strongly. The structure of the guanidine cation and of a number of thorium complexes is discussed. (tr-auth)

5671 SAMARIUM AND EUROPIUM PERTECHNETATES. Zaitseva, L. L.; Konarev, M. I.; Velichko, A. V.; Sukhikh, A. I.; Chebotarev, N. T. Zh. Neorg. Khim.; 19: No. 10, 2674-2678(Oct 1974). (In Russian).

Samarium and europium pertechnetates were isolated and their properties determined. The compounds may be represented by the general formula $R(TcO_4)_3 \cdot 3H_2O$ (R = Sm, Eu). Thermographic and thermogravimetric analyses showed that the initial crystallohydrates of samarium and europium pertechnetates are dehydrated in two stages, similar to dehydration of lanthanum and cerium pertechnetates. X-ray analysis indicated and infrared spectroscopy verified that the isostructure of the trihydrate, monohydrate, and anhydrous samarium pertechnetate corresponds to that of europium pertechnetate. (tr-auth)

5672 MORPHOLOGICAL AND STRUCTURAL STUDY OF URANIUM CHALCOGENIDE CRYSTALS. Ellert, G. V.; Kuz'micheva, G. M.; Eliseev, A. A.; Slovyanskikh, V. K.; Morozov, S. P. (Inst. of General and Inorganic Chemistry, Moscow). Zh. Neorg. Khim.; 19: No. 10, 2834-2838(Oct 1974). (In Russian).

The morphological characteristics of the growth of monocrystals of β-US_3, β-USe_3, U_2S_5, UOS, and US_2 were studied. The predominating faces, symmetry classes, and point groups were determined. During x-ray structural studies with computer processing of the results, the atomic coordinates and the forms of the coordination polyhedrons were established for the compounds β-US_3, β-USe_3, and UOS. The reasons for the location of the heavy atoms in U_2S_5 were determined. (tr-auth)

5673 TERMOKHIMIYA SOEDINENIJ REDKOZEMEL'NYKH I AKTINOIDNYKH EHLEMENTOV. (Thermochemistry of Rare Earth and Actinide Compounds). Krestov, G. A. Moscow; Atomizdat (1972). 263p. (In Russian).

310 refs.

Problems of thermochemistry of rare earth and actinide compounds are considered from the viewpoint of modern concepts. The dependence of inter-ion distances and crystallo-chemical radii of ions on temperature was examined systematically. Many unknown properties (thermodynamic, structural, etc.) of ions and simple compounds of some of the rare earths and actinides were determined at different temperatures, along with property changes in ionization, hydration, solution, formation, and ion sublimation. The latter are considered in relation to the theory of ion hydration, water structure, and ionic solutions. Tables are given of values of the properties and changes occurring in the processes studied at different temperatures. (tr-auth)

5674 RADIOACTIVE AMALGAM KRYPTONATES. I. Production of Radioactive Amalgam Kryptonates. Dillinger, P.; Teldesy, J.; Lukacs, P. (Chemical-Technological Inst., Bratislava, Czech.). Isotopenpraxis; 10: No. 8, 293-298(Aug 1974). (In Russian).

Production of these substances both by diffusion and by ion bombardment is described. The production of radioactive cadmium amalgam kryptonate is presented as an example. (auth)

5675 PRODUCTION OF HIPPURAN-^{131}I AT BORIS KIDRIC INST., VINCA. II. Investigation of the Stability of Sodium ^{131}I-Hippurate as a Function of the Ageing Time, Presence of Some Bacteriostatics and Stabilizers, Radioactivity, and the Sterilization Process of its Solutions. Draskovic, R. S.; Bzenic, J.; Ratkovic, M.; Draskovic, R. J. (Inst. of Nuclear Science, Vinca, Yugoslavia). Isotopenpraxis; 10: No. 10, 290-293(Aug 1974).

Stability of radioactive sodium ^{131}I-hippurate produced at the Boris Kidric Institute, Vinca, according to the modified procedure for application in nuclear medicine in Yugoslavia was investigated. In these investigations stability was observed as a function of the ageing time of the solutions, their radioactivity (A mCi/ml; A mCi/mg of the carrier; A_{act}), the presence of some bacteriostatics and stabilizers (C_6H_5-CH_2OH, Na-citrate), sterilization process and storage conditions. (auth)

5676 DEUTERIUM LOCATION IN DEUTERIUM TRIURANATE, $D_2U_3O_{10}$, BY NEUTRON DIFFRACTION. Taylor, J. C.; Wilson, P. W. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Acta Crystallogr., Sect. B; 30: No. 1, 151-154(15 Jan 1974).

The deuterium atom in the deuterium triuranate crystal, $D_2U_3O_{10}$, has been located by the method of powder neutron diffraction and is attached to the O(2) atom in the pentagonal ring of the pentagonal bipyramid around U(2), as predicted by earlier workers. It forms a bifurcated deuterium bond with the O(1) atom of a neighboring octahedron around U(1) and the O(5) atom of a neighboring pentagonal bipyramid. The O(2)-O(1) and O(2)-O(5) hydrogen bond distances are 2.76(6) and 2.76(7) Å and the hydrogen bond angles 101(4)° and 133(3)° respectively. The hydroxyl O-D distance is 1.09(4) Å. (auth)

5677 STRUCTURE OF URANYL CHLORIDE MONOHYDRATE BY NEUTRON DIFFRACTION AND THE DISORDER OF THE WATER MOLECULE. Taylor, J. C.; Wilson, P. W. (Australian Atomic Energy Commission, Sutherland). Acta Crystallogr., Sect. B; 30: No. 1, 169-175(15 Jan 1974).

$UO_2Cl_2.H_2O$ and $UO_2Cl_2 \cdot D_2O$ have the space-group symmetry $P2_1/m$ with Z = 2, and lattice constants, respectively, a = 5.836 (3), b = 8.563 (3), c = 5.566 (2) Å, β = 97.70° and a = 5.847 (9), b =

8.596 (13), c = 5.543 (9) Å, β = 97.51 (8)°. Neutron-diffraction powder studies of the two compounds have shown that previously assigned parameters of the uranyl oxygen and water oxygen atoms require modification. There is a pentagonal bipyramidal configuration around the uranium atom and the pentagonal ring consists of four chlorine atoms and a water oxygen atom. The interatomic distances and angles in the bipyramid are normal and close to the values found by neutron diffraction in a similar ring system in anhydrous UO_2Cl_2. The water molecule was found to be disordered. Half-hydrogens (or D) were observed in hydrogen bonding with the uranyl oxygens O(1) and O(2) (half-water molecule in mirror plane) and half-hydrogens (or D) were observed in hydrogen bonding with chlorine atoms above and below the mirror plane (half-water molecule in plane perpendicular to mirror plane). The hydrogen bond distances correspond to weak hydrogen bonding. (auth)

5678 STRUCTURE OF $UOCl_2$ BY NEUTRON DIFFRACTION. Taylor, J. C.; Wilson, P. W. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Acta Crystallogr., Sect. B; 30: No. 1, 175-177(15 Jan 1974).

The coordinates of the U, O and Cl atoms in the crystal structure of $UOCl_2$ have been determined by a least-squares fitting of the observed and calculated neutron powder diffraction profiles. $UOCl_2$ is isostructural with $PaOCl_2$ and the bond-lengths and angles in the two structures are identical within the experimental errors. (auth)

5679 CERIUM AND LANTHANUM PERTECHNETATES. Zaitseva, L. L.; Konarev, M. I.; Velichko, A. V.; Sukhikh, A. I.; Chebotarev, N. T. Zh. Neorg. Khim.; 19: No. 9, 2352-2357(Sep 1974). (In Russian).

Crystalline hydrates and anhydrous La and Ce pertechnetates were synthesized and studied by chemical, thermographic, thermogravimetric, and x-ray analytical methods. X-ray phase analysis and infrared spectroscopy were used to confirm structure changes that occur in dehydration according to the reaction $R(TcO_4)_3 \cdot 3H_2O \rightarrow R(TcO_4)_3 \cdot H_2O \rightarrow R(TcO_4)_3$. (tr-auth)

5680 REACTION OF UO_2Cl and $UOCl_2$ WITH $MoCl_5$, MoOCl, AND WCl_6. Eliseev, S. S.; Glukhov, I. A.; Vozhdaeva, E. E.; Malysheva, L. E. Zh. Neorg. Khim.; 19: No. 9, 2403-2408(Sep 1974). (In Russian).

At temperatures of ≤200°C, UO_2Cl and $UOCl_2$ enter into both exchange and oxidation-reduction reactions with $MoCl_5$, $MoOCl_4$, and WCl_6. Six reactions are discussed. (tr-auth)

5681 LiCl–$PbCl_2$–UCl_4 TERNARY SYSTEM. Desyatnik, V. N.; Korol'kov, V. A.; Kurbatov, N. N.; Raspopin, S. P. (Ural Polytechnical Inst., Sverdslovsk, USSR). Zh. Neorg. Khim.; 19: No. 9, 2593-2595(Sep 1974). (In Russian).

A DTA method was used to study the melting diagram of the ternary system LiCl–$PbCl_2$–UCl_4. The uranium tetrachloride formed two ternary eutectics and one peritectic with the lithium and lead chlorides, with melting points of 320 ± 2, 290 ± 2, and 305 ± 2°C, respectively. A quasi-binary region of the system was found, $2LiCl \cdot UCl_4$–$PbCl_2$. (tr-auth)

5682 THERMOCHEMISTRY OF URANIUM COMPOUNDS. IV. Standard Enthalpy of Formation of Sodium Uranium(IV) Trioxide ($NaUO_3$). O'Hare, P. A. G.; Hoekstra, H. R. (Argonne National Lab., IL). J. Chem. Thermodyn.; 6: No. 10, 965-972(Oct 1974).

A pure carefully characterized sample of sodium uranium(V) trioxide, $NaUO_3$, has been reacted in a calorimeter containing an aqueous mixture of HCl and XeO_3. Based on the enthalpy of reaction, the standard enthalpy of formation, ΔH_f° ($NaUO_3$, c, 298.15 K), has been determined to be –(357.5 ± 0.8) $kcal_{th}$ mol^{-1}. Derived thermodynamic data attest to the significant stability of $NaUO_3$. (auth)

5683 SYNTHESIS OF TRITIUM-LABELED HEXADEOXYNUCLEOTIDE COMPLEMENTARY TO A PORTION OF THE RNA OF PHAGE R17. Metelv, V. G.; Drutsa, V. L.; Smirnov, V. D.; Shabarova, Z. A.; Prokof'ev, M. A. (Moscow State Univ.). Dokl. Biochem. (Engl. Transl.); 215: No. 1-6, 112-115(1974).

Translated from Dokl. Akad. Nauk SSSR; 215: No. 2, 466-469 (Mar 1974).

Synthesis of the hexadeoxynucleotide d(pGpGpTpApApT) and the introduction of a tritium label into it are reported. (LK)

5684 SYNTHESIS OF [^{3}H]GIBBERELLIN A_3 AND [^{3}H]GIBBERELLIN A_1 BY THE PALLADIUM-CATALYZED ACTIONS OF CARRIER-FREE TRITIUM ON GIBBERELLIN A_3. Nadeau, R.; Rappaport, L. (Univ. of California, Davis). Phytochemistry; 13: No. 8, 1537-1545(Aug 1974).

Reaction of gibberellin A_3 (GA_3) with carrier-free tritium gas and 5% palladium on calcium carbonate as catalyst gave a complex mixture of products, several of which were isolated and identified. Three of the purified products are the radioactive forms of naturally occurring gibberellins: [^{3}H]GA_3 (1), [^{3}H]GA_1 (2) and [^{3}H]tetrahydro GA_3 (4). Another substance was isolated and tentatively identified as [^{3}H]16, 17-dihydro GA_3 (3). GLC was used to determine the specific activities of 1 and 2. [^{3}H] GA_3 likely arises from palladium catalyzed nonspecific exchange of GA_3 alkane hydrogen atoms with tritium. [^{3}H]GA_1 is also exchange labeled but most of its radioactivity is due to tritium addition to the C-1,2 olefinic bond of GA_3. (auth)

5685 ACTINIDE CHALCOGENIDES AND PNICTIDES. III. Optical-Phenon Frequency Determination in UX and ThX Compounds by Neutron Scattering. Wedgewood, F. A. (UKAEA Research Group, Harwell, Eng.). J. Phys., C (London); 7: No. 18, 3203-3218(21 Sep 1974).

The optical-phonon branch in actinide compounds is flat provided there is both a large mass difference between the actinide ion and the lighter anion and negligible interaction between neighboring anions. For such a compound the neutron time-of-flight spectrum using a polycrystalline sample will give a sharp peak at the optical frequency. This concept is used here in measuring the mean optical frequency for nine AnX compounds with the rock-salt structure where An = U and Th and X = C, N, P, S and Se. The optical frequency is interpreted in terms of a single nearest-neighbor An-X force constant. It is found that the U-X force constants are 20 to 30% higher than the corresponding Th-X force constants. In both cases the constants increase with the An-X separation. UC and ThC have anomalously low force constants. (auth)

5686 SYNTHESIS OF TRYPTOPHAN STEREOSELECTIVELY LABELLED WITH TRITIUM AND DEUTERIUM IN THE β-METHYLENE GROUP: THE STERIC COURSE OF HYDROXYLATION IN SPORIDESMIN BIOSYNTHESIS. Kirby, G. W.; Varley, M. J. (Univ. of Glasgow). J. Chem. Soc., Chem. Commun.; No. 20, 833-834(23 Oct 1974).

The (3R)- and (3S)- forms of [3-^{3}H] tryptophan have been synthesized by the oxazolinone method and used to show that side-chain hydroxylation in the biosynthesis of sporidesmin A takes place with retention of configuration at the site of attack. (auth)

5687 SOME PROBLEMS IN THE DETERMINATION OF ACIDITY IN NITRIC ACID SOLUTIONS OF PLUTONIUM NITRATE. Savage, D. J. (UKAEA Reactor Group, Dounreay, Eng.). Proc. Soc. Anal. Chem.; 11: No. 10, 226-268(Oct 1974).

In the determination of acidity in plutonium solutions from nuclear fuel reprocessing, it is of prime interest to determine the "free acid," and methods of eliminating the effects of hydrolysis must be considered. Experiments are described which show that complexing the plutonium by the addition of excess of fluoride will prevent the hydrolysis of both plutonium(IV) and plutonium(VI) during alkimetric titration. Consideration of the relevant stability data tends to confirm these findings and alkimetric titration using pH end-point detection in the presence of excess of fluoride is a valid technique for determining the free acidity of plutonium solutions. (UK)

5688 THERMODYNAMICS OF URANYL COMPLEXES WITH THREONINE AND HYDROXYPROLINE. Sekhon, B. S.; Chopra, S. L. (Punjab Agricultural Univ., Ludhiana (India). Dept. of Chemistry and Biochemistry). Thermochim. Acta; 7: No. 4, 311-316(Nov 1973).

The stability constants of uranyl complexes with threonine and hydroxyproline were studied in aqueous solutions at 25 and 45°C by the Calvin–Bjerrum technique. Thermodynamic stability constants were obtained by extrapolation of the values at various ionic strengths. The values of stepwise changes in ΔG, ΔH, and ΔS are reported. The log K_1/K_2 values are positive for the threonine and hydroxyproline complexes and greater stability is achieved at lower temperatures. The stability decreases with the increase in ionic strength. The values of ΔH are negative and those of ΔS are positive for uranyl complexes with both ligands. This shows that both terms are favorable for the formation of complexes. The hydroxyproline complexes are slightly more stable than their corresponding threonine complexes. (INIS)

5689 SPECTROPHOTOMETRIC STUDY OF THE COMPLEXATION REACTION BETWEEN URANIUM(VI) AND SALICYLANILIDE. Pannu, B. S.; Sekhon, B. S.; Chopra, S. L. (Punjab Agricultural Univ., Ludhiana (India). Dept. of Chemistry and Biochemistry). J. Indian Chem. Soc.; 50: No. 10, 651-653(Oct 1973).

Salicylanilide forms orange yellow complexes with uranium ion in a 50% aqueous ethanol at pH 7.0 ± 0.1 that was studied spectrophotometrically. The results of Job's method, molar ratio method, and limiting logarithmic method indicate 1 : 1 composition for the complex, which has a maximum absorbance at 420 nm and obeys Beer's law in the range of 1 to 40 μg of uranium(VI) per ml. The apparent stability constant of the complex is 4.74 at 20° ± 0.5°. (auth)

5690 THE REACTION OF AMALGAMS WITH AMMONIA. Ettmayer, P.; Jangg, G. (Technische Hochschule, Vienna (Austria). Inst. fuer Chemische Technologie Anorganischer Stoffe). Monatsh. Chem.; 104: No. 4, 1120-1130(Jul 1973). (In German).

The reactions between ammonia and the amalgams of Mn, U, Ti, Al were investigated. The reaction products were identified as Mn_3HgN, $UN_{1.4+x}$, TiN, and AlN. Within a wide concentration range of the metals in the amalgam, the rate of reaction corresponds to a zero order reaction and is independent of the metal concentration. In the case of Ti and Al amalgams, the zero order reaction is superimposed by an autocatalytic component. The amalgams of the metals Fe and Cr which have very low solubility in mercury, react so slowly, that the reaction products could neither be isolated nor identified. (auth)

5691 COMPOSITION AND STABILITY OF URANIUM(VI) – SOLOCHROME GREEN V150 COMPLEX. Jain, A. K.; Agrawal, V. P.; Puran Chand; Garg, S. P. (Jodhpur Univ. (India). Chemical Labs.). J. Indian Chem. Soc.; 50: No. 8, 517-520(Aug 1973). 8 refs., 4 figures.

Uranium(VI) reacts with Solochrome Green V150 to form a deep blue colored complex in pH range 7.6 to 10.10. The complex formation is instantaneous. The absorbance values for the complex remain unchanged on keeping it for a week indicating thereby the stability of the complex. Spectral data show the formation of only one 1 : 2 complex with λ_{max} at 605 nm at pH 8.95. The composition of the complex (1 : 2) has also been confirmed by conductometric method. The stability constant of the complex was calculated by the method of Banerji and Dey and mole ratio method. The results are fairly close to each other. The free energy of formation was also determined at 30°C. (auth)

5692 PREPARATION AND APPLICATION OF RADIOPHARMACEUTICALS. I. Introduction. Komarek, P.; Chalabala, M. (Katedra Farmaceuticke Technologie Institutu pro Dalsi Vzdelavani Lekaru a Farmaceutu, Prague (Czechoslovakia)). Farm. Obz.; 42: No. 11, 499-504(1973). (In Czech).

Fundamentals in the sphere of radiopharmaceuticals are listed, their classification according to physical properties and diagnostical application is given, and their preparation is briefly described. The quality evaluation of radiopharmaceuticals is discussed, and the necessity is stressed of proper designation of preparations and of documentation on radioactive substances. (INIS)

5693 DETERMINATION OF CORRECTIONS FOR ^{14}C BETA SELF-ABSORPTION IN $BaCO_3$. Uzhovskaya, A. G.; Lur'e, A. A. (Inst. of General and Communal Hygiene, Moscow). Gig. Sanit.; No. 8, 66-68(Aug 1974). (In Russian).

The beta self-absorption curve for $Ba^{14}CO_3$ showed a maximum at a thickness of 0.05 g/cm^2, apparently as a result of reflection of beta particles from the backing. From count rate measurements for thicknesses from 0.15 to 100 mg/cm^2, corrections were determined and presented in tabular form for use in other work. (MG)

5694 COMPUTER PROGRAM FOR COMPUTATION OF K, U, Th, AND ASSOCIATED DATA FROM LABORATORY GAMMA-RAY SPECTROMETER OUTPUT. Killeen, P. G. (Mineralogisk-Geologisk Museum, Oslo). Norsk Geologisk Tidsskrift; 53: 315-316(1973).

There is at present an increasing realization of the importance of knowledge of the distribution of the radioelements thorium, uranium and potassium, particularly for computing the radiogenic contribution to heat flowing from the earth's surface. A computer program (KUTH) was written to handle output data from laboratory gamma spectrometers. KUTH has a form which will take summations from the three radioelement peaks, counting time and sample weight as input on punched cards and compute the concentrations of K, U, Th, and K oxide, the ratios Th/U, Th/K, U/K and heat production. When the input consists of counting data from several samples, tables of values are listed and a set of useful statistics is computed including geometric means, arithmetic means, variance, coefficient of variation, standard error of the means, etc., for each of the above variables. In addition, since raw counts are used as input, estimated errors for each analysis are computed based on counting statistics. (NO)

5695 PROCESSES OF ENTRY OF Am AND Cm INTO A PLASMA WITH A HOLLOW CATHODE DISCHARGE. Zakharov, E. A.; Myasoedov, B. F.; Lebedev, I. A.; Ozhegov, P. L.; Karyakin, A. V. Zh. Prikl. Spektrosk.; 21: No. 2, 239-243(Aug 1974). (In Russian).

The dependence of the intensity (I) of Am, Cm, Eu, and Gd lines on the discharge current (i) was studied. Volt-ampere characteristics, U = f(i), of the luminescence of the discharge in the hot hollow cathode were measured at the beginning and end of the exposures. From comparisons of I = f(i) of the border N_2^+ 391.44 (F) nm and lines H_γ, H_δ with U = f(i), the effect of nitrogen and of hydrogen on U = f(i) in the discharge process was shown to be different. Thermodynamic estimates of the temperature dependences of the equilibrium pressures of Am, Cm, Eu, and Gd over their oxides and carbides are presented. Estimates are given of the effective cross-section of dispersion of electrons in the plasma of angular hot hollow cathodes. For currents of 300 mA or less, the shape of U = f(i) was determined by the dispersion of electrons by Am, Cm, Eu, and Gd atoms, which enter into the result of dissociation of the solid carbides of these elements formed in the hot hollow cathode. Burn-up of Cm was measured. Up to 97% of the Cm remained in the angular hot hollow cathode. Conditions for determining Am in Cm, selected on the basis of studies with Eu and Gd, were not optimum. (tr-auth)

Radioactive Waste Treatment

Refer also to abstract 7718.

5696 (AAEC/E-322) METHYL IODIDE PENETRATION OF CHARCOAL BEDS: VARIATION WITH RELATIVE HUMIDITY AND FACE VELOCITY. May, F. G.; Polson, H. J. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Sep 1974. 24p. Dep. NTIS (US Sales Only) $4.25.

The retention of methyl iodide in charcoal beds was found to vary with the distance from the leading edges of the beds. Near the leading edges, retention was less than in the deeper regions, probably due to the chemisorption of competing vapors in the airstream drawn through the beds. One of the poisoning agents was identified as di-methyl sulfate vapor. The penetration of methyl iodide fell exponentially with distance in the deeper regions of the beds. The slope of the penetration curves in these deeper regions was dependent on the relative humidity and the face velocity in a more complex manner than the simple relationship assumed in the "Stay Time" concept. An empirical formula, which gave the slope of the penetration curve within a standard deviation of 7%, was derived to correlate the parameters over the range of practical interest, i.e., 30 to 99% relative humidity and from 1.1 m sec^{-1} down to at least 0.16 m sec^{-1}, and probably much lower. The uncertainty in the results could have been caused by variations within the batches of charcoal. A formula was derived to translate the results of an in situ test at a measured flowrate and humidity into an expected performance at high humidity and any other flowrate. The expression is independent of the slope of the penetration curve and the thicknesses of both the poisoned and unpoisoned regions of the bed, which suggests that it may be valid even for heavily poisoned beds. (auth)

5697 (BNWL-1802) PACIFIC NORTHWEST LABORATORY MONTHLY ACTIVITIES REPORT, NOVEMBER 1973. Division of Production and Materials Management and Hanford Plant Assistance Programs. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1973. Contract AT(45-1)-1830. 20p. Dep. NTIS $4.00.

Progress in the following radioactive waste management activities at the Hanford plant is reported: waste concentration and encapsulation; Pu trench soil characteristics studies; prevention of accidental release of contaminants; mapping of ground water system; and research on effects of plant age, chemical form and depth of placement on plant uptake of transuranium elements from the soil. (LCL)

5698 (BNWL-1820) FEASIBILITY STUDIES FOR DECONTAMINATION AND DENSIFICATION OF CHOP-LEACH CLADDING RESIDUES. Griggs, B. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1974. Contract AT(45-1)-1830. 54p. Dep. NTIS $5.45.

The properties of the chop-leach cladding hull waste stream is reviewed with respect to aqueous, molten salt, and molten metal decontamination. The removal of transuranic contamination and densification of the waste stream by melting appear feasible but technically difficult to produce an acceptable product with only a small increase in the mass of the total waste stream. Research is indicated to develop a process utilizing a gaseous film alteration, aqueous film removal and etching, and flux extraction of the molten metal. (auth)

5699 (CEA-CONF-2700) CONTINUOUS DETECTION OF THE RADIOACTIVE CONTAMINATION OF SUSPECT EFFLUENTS. Peray, R.; Juste, G.; Descamps, A. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 -Saint-Paul-les-Durance (France)). [nd]. 13p. (In French). (CONF-740556-8). Dep. NTIS (US Sales Only) $4.00.

From Seminar on the monitoring of radioactive effluents; Karlsruhe, F. R. Germany (14 May 1974).

Some of the liquid wastes at Cadarache are not necessarily radioactive but may be. In the past it has been the policy to store

these wastes before determining their possible radioactivity. A new system based on the continuous $\beta-\gamma$ monitoring of these wastes was developed and put into operation so that non-radioactive wastes could be immediately passed into the sewer system without need for storage. The new system has an automatic alarm system if a radioactive threshold level is reached. The components of the system, its calibration, and operation are described. (JSR)

5700 (RFP-2271) PILOT PLANT DEVELOPMENT OF A FLUIDIZED BED INCINERATION PROCESS. Ziegler, D. L; Johnson, A. J.; Meile, L. J.; Johnston, A. L.; Shamhart, E. L. (Dow Chemical U. S. A., Golden, Colo. Rocky Flats Div.). 14 Oct 1974. Contract AT(29-1)-1106. 13p. Dep. NTIS $4.00.

Pilot plant scale tests were made on a fluidized bed incineration process under development at the Rocky Flats Plant. The hydrogen chloride produced from combustion of chloride-containing plastics reacts with sodium carbonate bed material in the primary combustion chamber. This minimizes equipment corrosion and eliminates the need for aqueous scrubbing of the flue gas. A packed bed and a fluidized bed of oxidation catalyst were evaluated for low-temperature afterburning of the flue gas. (auth)

5701 ECONOMIC PROCESS FOR THE REMOVAL OF ^{90}Sr AND ^{137}Cs FROM INDUSTRIAL WASTE WATERS. van der Horst, J. M. A. (Surface Research, Inc., Olean, N.Y. (USA)); Hartman, R. E. (Saint Bonaventure Univ., N.Y. (USA)). Metalloberflaeche-Angew. Elektrochem.; 28: No. 5, 170-173(May 1974). (In German). 4 figs.; 40 refs.

The ion-exchange efficiency of cement and fire-bricks with respect to ^{90}Sr and ^{137}Cs was studied. Those bricks show an excellent ion-exchange capacity for the above-mentioned contaminants and, hence, are useful for the removal of these radioisotopes from radioactive waste water prior to the discharge into natural surface waters. The costs of the process are evaluated. (GE)

5702 BITUMINIZATION OF RADIOACTIVE WASTES AT THE NUCLEAR RESEARCH CENTER, KARLSRUHE. Hild, W.; Kluger, W.; Krause, H. (Kernforschungszentrum, Karlsruhe, Ger.). Trans. Amer. Nucl. Soc.; 19: 206-207(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5703 IMMOBILIZATION OF SPENT-CLADDING HULLS BY CONVERSION TO SILICATE FORMS. Schulz, W. W.; Dressen, A. L. (Atlantic Richfield Hanford Co., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 207-208(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5704 SEPARATION OF NOBLE GASES BY USING POROUS MEMBRANES. Maekawa, T.; Ishimori, T. (Mitusbishi Atomic Power Industries, Inc., Tokyo). Genshiryoku Kogyo; 20: No. 4, 36-39(Apr 1974). (In Japanese).

The release of noble gases from nuclear power plants is now a problem in connection with the preservation of environment. To remove krypton as such, the method with porous diaphragms has been studied experimentally, and the investigation into its industrialization is proceeding at present. The experimental apparatus consists of a four-stage cascade with TFE diaphragms. Using a mixture of nitrogen and krypton (less than 1%), the separation factor obtained was about 1.6 ~ 1.7. Since the operating conditions are close to normal temperature and atmospheric pressure, the operation is easy and safe. The extension to a square cascade and to a practical facility is discussed, and comparison with other methods is made. (JA)

5705 REDUCING RADIO-ACTIVE WASTES. Lerch, R. E.; Cooley, C. R.; Atwood, J. M. (Westinghouse Hanford Co., Richland, WA). Chem. Process. (London); 20: No. 9, 9-10(Sep 1974).

A brief account is given of a new process being developed by Westinghouse at their Hanford Engineering Laboratory to treat contaminated combustible waste materials such as paper and plastics. Hot concentrated sulphuric acid is used, in the presence of nitric acid, to convert the waste materials into non-combustible residues of considerably less volume, by carbonization and subsequent oxidation. (UK)

5706 DECONTAMINATION OF RADIOACTIVITY FROM WASTE INCINERATOR EXHAUST-GAS AT TOKAI ESTABLISHMENT, JAERI. Kato, K.; Naito, K.; Machida, C. (Japan Atomic Energy Research Inst., Tokai). Hoken Butsuri; 9: No. 2, 81-86 (Jun 1974). (In Japanese).

The radioactive waste incinerator at Tokai Research Establishment, JAERI was installed in 1966, and has been operated routinely for seven years. In the operation, a lot of inadequate parts of the incinerator such as furnace, spray scrubber, cyclone, and electrostatic precipitator have been improved. This experimental program was carried out to examine the decontaminability of furnace and exhaust-gas system. The decontamination factors (DF) of the incinerator components were determined by obtaining the ratio of activity of ^{32}P in the influent gas to that in the effluent gas. DF of 3.6×10 in the spray scrubber and 7.0×10 in the electrostatic precipitator were obtained. Retention factor in the furnace was 2.3×10. Using the value of 1.0×10^2 in the cloth filter and 1.0×10^3 in the HEPA filter obtained in the previous examination (in 1966), the over-all DF of the incinerator was calculated to be 6×10^9. Also the distribution of radioactive material in each part of incinerator was 93% in the ash, 5% in the spray scrub solution, 0.5% in the electrostatic precipitator, 0.02% in the cloth filter, and 0.3% in the duct of exhaust-gas. (auth)

Radioisotope Production

5707 (ALKEM-^{238}Pu-1) PRODUCTION AND USE OF PLUTONIUM-238. Irradiation of Neptunium-237 for the Production of Plutonium-238. Beisswenger, H. (Alpha Chemie und Metallurgie G.m.b.H. (ALKEM), Grossauheim (F. R. Germany)). [nd]. 26p. (In German). INIS.

3 figs.; 5 tabs.; 7 refs.; with apps. With abstract in German and English. Available from ZAED.

The aim of irradiating about 180 g Np-237 was to produce approximately 10 g Pu-238 for experimental purposes and to obtain experience in the planning and carrying out of such a project. It is the first step to a later economical production of ^{238}Pu to be done and to clarify what ^{238}Pu quality (^{238}Pu share) and what yield with the design conditions can be obtained and the easiest and most economical form of producing ^{238}Pu. Fuel pellets of NpO_2 were prepared in an iron matrix, the iron cermet pellets collected into pellet columns and put into rods with Zircaloy-2 cladding tubes. The comprehensive control of production is described and the factory acceptance certificate is given. The irradiation took place in the BR-2 in Mol at a flux of about 1.1×10^{14} n/cm^{2}s. The irradiation results are given in tables. The production of ^{238}Pu by irradiation of ^{237}Np requires a restriction of the irradiation times to keep the costs within reasonable limits. A compromise between the production of ^{238}Pu on the one hand and an acceptable quality of the final product on the other hand is needed. (GE)

5708 (JINR-E6-8057) INVESTIGATION OF THE DIFFUSION PROCESS AT ELECTROMAGNETIC SEPARATION OF THE RADIOACTIVE ISOTOPES OF RARE-EARTH ELEMENTS. Latuszynski, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 24p. Dep. NTIS (US Sales Only) $4.25.

Making use of the measurement results for the efficiency of migration of radioactive rare earth elements out of the tantalum target, the values have been found for the diffusion coefficients at different temperatures of the target. A concise theoretical consideration for the diffusion process is given which makes it possible to estimate the activity expected for the short-lived isotopes on the collector of the electromagnetic mass-separator in "off-line" and "on-line" regimes. (auth)

5709 (ORNL-4965) TRANSURANIUM PROCESSING PLANT SEMIANNUAL REPORT OF PRODUCTION, STATUS, AND PLANS FOR PERIOD ENDING DECEMBER 31, 1973. King, L. J.; Bigelow, J. E.; Collins, E. D. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 28p. Dep. NTIS $4.00.

This is the twelfth report in a series that is being issued semiannually to inform the heavy-element community of the status and future production plans of the Transuranium Element Production Program at ORNL. During the period July 1, 1973, through December 31, 1973, we recovered transuranium elements from 10 irradiated HFIR targets. In addition, we repurified 77 g of ^{244}Cm (81 g of curium) for the Heat Source Program at the ORNL Isotopes Division, and began a campaign to recover transuranium elements from accumulated rework materials. In product finishing operations, we processed 2 g of ^{243}Am, 92 g of ^{244}Cm (160 g of curium), 221 mg of ^{252}Cf, 737 μg of ^{253}Es (mixed isotopes), 183 μg of high-purity ^{253}Es, and approximately 0.5 pg of ^{257}Fm. Thirty-five shipments were made from TRU during the period. Eleven HFIR targets, each containing 7 to 9 g of actinides (predominantly curium), were fabricated. During the next 18 months, we expect to recover totals of 50 mg of ^{249}Bk, 555 mg of ^{252}Cf, 2.3 mg of ^{253}Es (in a mixture of isotopes), 255 μg of high-purity ^{253}Es, and 1.5 pg of ^{257}Fm. Also, we expect to obtain 75 mg of high-purity ^{248}Cm from purified californium now in storage. Currently, we do not plan to process any of the remaining SRP Pu-Al tubes or to irradiate any plutonium targets in the HFIR; thus, we do not expect to recover any ^{244}Pu. There have been no changes in the chemical processing flowsheets normally used at TRU during this report

period. In maintenance operations, one of the three sampler equipment racks (Cubicle 7) was replaced. The new rack contains an improved transfer system that utilizes vacuum tanks in place of pumps. Six of the eight glass windows in the Equipment Decontamination Glove Box were replaced with Rowlex (polycarbonate) windows, each equipped with a new glove system — La Calhene J2L Containment Elements, Type 33 — distributed by Central Research Laboratories, Inc. Six neutron sources were fabricated, bringing the total fabricated to 69; 4 sources that had been used in various projects were returned to TRU for reassignment or reprocessing. In special projects, a new experimental facility designed to hold a standard HFIR target in one of the VXF holes of the HFIR beryllium reflector was approved; a special target, ST-8, which contained several samples and flux monitors, was fabricated and irradiated in the VXF facility. A new technique using magnesium diluent was developed and used to fabricate milligram amounts of ^{249}Bk into HFIR hydraulic rabbit capsules for production of ^{250}Cf; approximately 372 μg of ^{250}Cf was obtained. In addition, a quartz ampul containing 1.8 mg of ^{152}Sm was encapsulated into a standard rabbit capsule, irradiated in HFIR, and shipped to ANL. The values that we are currently using for transuranium element decay data and for cross-section data in planning irradiation-processing cycles, calculating production forecasts, and assaying products are tabulated in the Appendix. (auth)

5710 PRODUCTION OF TRANSURANIC ELEMENTS. Ueno, K. (Japan Atomic Energy Research Inst., Tokai). Genshiryoku Kogyo; 20: No. 4, 9-14(Apr 1974). (In Japanese).

Transuranic elements are produced artificially because they actually do not exist in nature. The production by neutron capture is divided into the method to employ reactors and that to use nuclear explosion. The former is further classified to the target bombardment with neutrons and the separation from used-up fuel. There are many examples for the target bombardment. The production by milking is the procedure to separate daughter nuclides from a parent nuclide after synthesizing the parent nuclide. In the production by the target bombardment with charged particles, the advantage is that the atomic number of generated new nuclide is approximately equal to the sum of that of target nuclide and charged particles. Transuranic element experiments in Japan, started by the production of ^{239}Np, have been developed considerably due to the increase of neutron flux available from research reactors to JMTR. The production of transuranic elements will enter a new stage by the operation of a reprocessing plant for used fuel leading to the mass recovery of plutonium. (JA)

5711 ACCELERATOR PRODUCTION OF MEDICALLY USEFUL POSITRON-EMITTING RADIOISOTOPES. Engler, R. A.; Rydin, R. A. (Univ. of Virginia, Charlottesville). Trans. Amer. Nucl. Soc.; 19: 55-56(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5712 APPLICATION OF HIGH VOLTAGE ELECTROPHORESIS FOR THE SEPARATION OF RADIONUCLIDES. 6. Countercurrent Electrophoresis for the Separation of Pure Yttrium-90. Buchtela, K. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Monatsh. Chem.; 105: No. 1, 105-113(Jan 1974). (In German).

Pure radionuclides are separated by countercurrent electrophoresis. These radionuclides migrate in a countercurrent of inactive isotopes of the radioactive impurities. Pure Yttrium-90 is separated (half life 63.50 ± 0.12 hours). Medical application of this radionuclide is discussed. (auth)

Reactor Fuel Reprocessing

Refer also to abstracts 5698 and 5976.

5713 (DOCKET-50201-154) WEST VALLEY REPROCESSING PLANT. Summary Schedule for Responses to AEC Questions Dated June 28, 1974. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 5 Aug 1974. 2p. Dep. NTIS $4.00.

5714 (DOCKET-50201-155) WEST VALLEY REPROCESSING PLANT. Request for Changes to the Design Basis Tornado Parameters. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 16 Sep 1974. 1p. Dep. NTIS $4.00.

5715 (DOCKET-50201-157) WEST VALLEY REPROCESSING PLANT. Safety Analysis Report, Supplement 7. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 19 Sep 1974. 134p. Dep. NTIS $9.75.

Supplement 7 contains the revised emergency plan for the NFS Reprocessing Facility. (LK)

5716 (DOCKET-50268-46) MIDWEST FUEL RECOVERY PLANT. Indemnity Agreement B-55, Amendment 4. (General Electric Co., San Jose, Calif. (USA). Nuclear Energy Div.). 6 Sep 1974. 2p. Dep. NTIS $4.00.

5717 (DOCKET-50268-47) MIDWEST FUEL RECOVERY PLANT. License Application, PSAR, Amendment 37. (General Electric Co., San Jose, Calif. (USA). Nuclear Energy Div.). 17 Sep 1974. 5p. Dep. NTIS $4.00.

5718 (DOCKET-50268-48) MIDWEST FUEL RECOVERY PLANT. Indemnity Agreement B-55, Amendment 3. (General Electric Co., San Jose, Calif. (USA). Nuclear Energy Div.). 11 Apr 1974. 2p. (DOCKET-701308-3). Dep. NTIS $4.00.

5719 (DOCKET-50332-48) BARNWELL NUCLEAR FUEL PLANT. License Application, PSAR, Amendment 1, Part II. (Allied-General Nuclear Services, Barnwell, S. C. (USA)). 29 Oct 1974. 74p. Dep. NTIS $6.75.

Part II of Amendment 1 consists principally of descriptions of changes resulting from engineering development, including the change in the building configuration that is referred to in detail in part I of Amendment 1. (LK)

5720 (DOCKET-701327-4) URANIUM HEXAFLUORIDE FACILITY. License Application, Environmental Report, Revision 3. (Allied-General Nuclear Services, Barnwell, S. C. (USA)). 6 Sep 1974. 219p. Dep. NTIS $14.00.

The effects on the environment of the construction and operation of the Uranium Hexafluoride Facility at the Barnwell Fuel Reprocessing Plant are described. (LK)

5721 (ORNL-TM-4520) EVALUATION OF HTGR PRIMARY BURNING. Snider, J. W.; Watkin, D. C. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 158p. Dep. NTIS $7.60.

An economic and technical comparative study was made of the reference method, fluidized-bed burning, and an alternative method, whole-block burning, for performing the primary burning step in HTGR fuel reprocessing. For each method, considerations were made of the ancillary equipment for heat removal and the fuel and ash handling; crushing was also included in the case of fluidized-bed burning. The scale of primary burning was that of a reprocessing plant handling the spent fuel from ~50,000-MW(e) HTGR generating capacity. Preliminary designs were prepared for the major equipment components and/or modules in canyons equipped with the necessary remote maintenance features. Cost estimates were prepared for the equipment items using a fractional cost factor for multiple modules. The cost of the building associated with the primary burning step was estimated using the volume of concrete in the heavily shielded canyons and the area of the operating corridors adjacent to or above the canyons. The cost of primary burning is guesstimated to be about $100 million, with no significant difference between fluidized-bed and whole-block burning. The layout of the various canyons suggests that a modular head-end plant with add-on capability is more easily obtainable with the whole-block burner than with the fluidized-bed burner. The development of a fluidized-bed burner with a low length/diameter ratio should be a developmental goal. (auth)

5722 (ORNL-TM-4587) AQUEOUS FUEL REPROCESSING QUARTERLY REPORT FOR PERIOD ENDING MARCH 31, 1974. Unger, W. E.; Vaughen, V. C. A.; Irvine, A. R.; Watson, C. D. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 61p. AT.

Plasma-arc cropping of the gas plenum sections of fuel assemblies resulted in highly acceptable cut faces with as little as 5% of the tube faces closed. The method does not appear to be feasible for disassembly or rod pulling. A nonconsumable rotary electrode cutting technique is being investigated as an alternative to the plasma-arc method. The method appears to be applicable to cropping, slitting, circumferential cutting, and waste consolidation. The characterization of the sheared product resulting from various combinations of shear blades, compactor shapes, and gas wrapper ductility was completed with prototype fuel containing porcelain as a stand-in for urania-plutonia. The development and initial testing of a sequential forming gag-compactor was completed, and modifications to the gull-wing compactor are being made. The first series of voloxidizer optimization studies with HEDL PNL X-7 fuel yielded the interesting information that the amount of residual tritium after voloxidation appears to be highly dependent on the sample position in the fuel rod. The temperature of voloxidation (550°C or 650°C) increased the amount of insoluble residue after 2 hr leaching in 8 M HNO_3 by 0.01 to 0.03% of the total fuel for the higher power levels (≥10 kW/ft). Insoluble residue particle sizes were found to be between about 0.5 μ and about 40 μ. Settling tests indicated that about 50% of the residue was in the range 8 to 20 μ and about 50% of the residue was in the

range 20 to 40 μ. Deactivating the fluoride with boron, as a potential soluble poison or as a corrosion inhibitor, did not destroy the effectiveness of the fluoride in dissolving the nitric-acid-insoluble residues. Nimonic PE-16 and embrittled type 446 stainless steels were severely attacked by 8 M HNO_3–0.05 M HF. Static-bed hull rinsing tests in engineering-scale equipment were inadequate to recover simulated HNO_3-insoluble fines. Rotary dissolver hull rinsing tests in a 12-in.-diam dissolver removed >99.5% of simulated HNO_3 insoluble fines. Design on a 48-in.-diam rotary dissolver for materials transport tests, seal evaluation, and off-gas control studies has been started. Continued tests of the Iodox system in a seven-plate bubble-cap tower indicate stage decontamination factors in the range of 3 to 35 with no decrease in efficiency with high CO_2 concentrations in the feed gas. Shakedown runs of a bench-scale system for concentrating nitric acid to 22 M for use in the Iodox system were started. The acid concentration flowsheet is based on an extractive distillation process using magnesium nitrate. Studies of the chemistry of the Iodox system were continued and equilibrium reactions and coefficients for the oxidization of I^0 to I^+ in the concentrated nitric acid-nitrous oxide system are reported. Studies of a plant system for removing volatile fission products from off-gas indicate that nitrogen oxide removal and final iodine removal processes can benefit from operating with compressed and dried gases that are required by the noble gas removal equipment. (auth)

5723 (ORNL-TM-4598) EVAPORATION OF SODIUM INTO AN INERT SWEEP GAS: AN EVALUATION OF THE PROCESS HAVING APPLICATION TO THE DEACTIVATION OF INTERNAL SODIUM IN LMFBR FUEL ASSEMBLIES. Groenier, W. S.; Jenkins, H. J. (Oak Ridge National Lab., Tenn.(USA)). Oct 1974. Contract W-7405-eng-26. 29p. AT.

The feasibility of removing metallic sodium from Liquid Metal Fast Breeder Reactor fuel assemblies by evaporation is being investigated. Numerous experiments were recently performed to determine the rate of evaporation of molten sodium as a function of temperature, pressure, and sweep gas velocity. In these experiments, a small amount of sodium was evaporated into a flowing stream of argon gas from a crucible containing a sodium pool with a known surface area. Other experiments included evaporation from a wire mesh coated with sodium. The vaporized sodium was transported downstream, cold-trapped, and subsequently oxidized using a small flow of air. The resulting sodium oxide was dissolved in dilute nitric acid to determine the amount of transported sodium. The results are compared with evaporation rates for sodium that were calculated using a mass-transfer correlation from the literature. This correlation assumes forced convection and involves the Sherwood, Schmidt, and Reynolds numbers: $Sh = 0.664(Sc)^{\frac{1}{3}} (Re_x)^{\frac{1}{2}}$. The comparison suggests that at temperatures from 1000 to 1300°F the correlation is useful for the prediction of rates at which sodium will evaporate into an argon sweep gas from an open pool. The results also indicate that evaporation is a feasible method for removing sodium from a fuel assembly. (auth)

5724 FLUIDIZED OXIDATIVE DISAGGREGATION OF PELLETIZED NUCLEAR FUEL. Ageenkov, A. T.; Savel'ev, V. F.; Valuev, E. M.; Nilov, N. A.; Gal'perin, E. N.; Rybakov, E. I. Sov. At. Energy (Engl. Transl.); 35: No. 5, 1052-1054 (Nov 1973).

Translated from At. Energ. (USSR); 35: No. 5, 362-363(Nov 1973).

Several models of fluidized-bed fluorinators were tested with a view to arriving at a suitable reactor design for stable fluidization of a mixture of uranyl uranate and inert packing, taking advantage of the developed contact surface of the fuel pellets in the fluidized bed, and for eliminating any possibility of stagnant pockets forming in the reactor. (LK)

5725 ENVIRONMENTAL CONCERNS IN FUEL REPROCESSING. Deuster, R. W. (Nuclear Fuel Services, Inc., Rockville, MD). Trans. Amer. Nucl. Soc.; 19: 210(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5726 SEPARATION OF FISSION PRODUCT METALS FROM SPENT URANIUM FUELS BY NITRIDING. Anderson, R. N.; Parlee, N. A. D.; Fuwa, A. (Stanford Univ., CT). Trans. Amer. Nucl. Soc.; 19: 228-229(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5727 REPROCESSING OF SPENT NUCLEAR FUEL. Schaefer, L.; Wojtech, B. (to Farbwerke Hoechst Aktiengesellschaft Vormals Meister Lucius and Bruning). US Patent 3,836,625. 17 Sep 1974. Priority Date 24 Nov 1970, F. R. Germany. 6p.

Reprocessing of nuclear fuel is improved by recovering uranium and thorium during an additional anticyclic liquid-liquid extraction process which is applied to the organic phase of the first extraction cycle. The improvement of the process is based on the addition of ethylenediaminetetra-acetic acid (EDTA) to the aqueous reextracting solution. (Official Gazette)

CONTROLLED THERMONUCLEAR RESEARCH

Confinement and Heating

Refer also to abstract 5957.

5728 (CONF-740642-2) rf HEATING OF A GUIDING-CENTER PLASMA IN THE CONTINUOUS SPECTRUM. Tataronis, J. A.; Grossmann, W. (New York Univ., N. Y. (USA). Courant Inst. of Mathematical Sciences). 1974. 7p. Dep. NTIS $4.00.

From 2nd topical conference on rf plasma heating; Lubbock, Texas, USA (20 Jun 1974).

The heating of a guiding center plasma (GCP) is considered by means of an externally applied rf source at frequencies in the continuous spectrum of the linearized equations of motion. Absorption arises from local resonances which characterize the continuum. The GCP spectrum is composed of components from ideal MHD and from Vlasov theory. An effective impedance of the system is calculated. From this impedance the average rate of energy absorption is deduced. Results obtained will be compared with the encouraging absorption rates already found for the strictly ideal MHD case. Connections to magnetic pumping and TTMP are drawn and comparisons with other current heating schemes are given. (auth)

5729 (IAEA-CN-33/A-5-1) PLASMA CONFINEMENT IN THE ORMAK DEVICE. Berry, L. A.; Callen, J. D.; Clarke, J. F. (Oak Ridge National Lab., Tenn. (USA)). 1974. 10p. (CONF-741105-32). Dep. NTIS $4.00.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Experiments in two different operating regimes of the Oak Ridge Tokamak (ORMAK), with ohmic heating, are discussed. The confinement characteristics of a broad profile discharge in a low density regime and a peaked profile discharge at high density are described in detail. Through charge-exchange analysis, particle diffusion coefficients for these discharges are evaluated, and it is shown that the particle diffusion is not a significant energy loss for the present operating conditions. Detailed examination of the radial power flow for the ions indicates that the dominant loss from the core is heat conduction, the form (and magnitude) of which is consistent with the neoclassical predictions, provided local collision frequencies are enhanced by an amount comparable to that inferred from the resistance anomaly. Examination of the electron power flow suggests anomalous behavior of the electrons. However, for the broad profile discharges, average confinement parameters, such as β_p or the energy confinement time, are reasonably consistent with pseudoclassical predictions. With increasing electron density, overall confinement improves, in spite of profile peaking ($\beta_p \sim \bar{n}_e/l$). The resistance anomaly is observed to scale roughly as $I^{\alpha}/\bar{n}_e$, where $\alpha \sim 1$. At high densities the volume-averaged effective ionic charge, $\langle Z_{eff}\rangle_{res}$, inferred from resistance anomaly shows a rough agreement with $\langle Z_{eff}\rangle_{meas}$, inferred from direct measurements (vacuum-ultraviolet spectroscopy, soft x-ray, and charge-exchange analysis of pitch-angle scattered fast ions in the neutral beam injection). However, with decreasing densities, $\langle Z_{eff}\rangle_{res}$ becomes (by a factor $\gtrsim 2$) higher than $\langle Z_{eff}\rangle_{meas}$, suggesting that the possibility of turbulent enhancement cannot be excluded. (auth)

5730 (IAEA-CN-33/A16-3) NEUTRAL BEAM INJECTION INTO TOKAMAKS. Callen, J. D.; Colchin, R. J.; Fowler, R. H.; McAlees, D. G.; Rome, J. A. (Oak Ridge National Lab., Tenn. (USA)). 1974. 19p. (CONF-741105-28). Dep. NTIS $4.00.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The theory of the plasma modifications induced by neutral beam injection into a tokamak is developed in detail. The system is treated as a three-component plasma—fast ions, background plasma ions and electrons. The fast ion treatment includes: (1) the initial fast ion spatial distribution; (2) energy and momentum transfer from the fast ions to the background plasma ions and electrons in the presence of impurities, charge exchange and an electric field; (3) a loss-region in velocity-space due to drift orbits that make large outward radial excursions for certain pitch-angle ranges; and (4) pitch-angle scattering into the loss-region during the fast ion slowing down process. The degree to which this fast ion component can model alpha particles in a reactor is discussed. The changes that the momentum and energy inputs from the fast ions induced in the plasma transport equations are derived. The resultant macroscopic plasma perturbations are calculated and, except for the density change, found to compare favorably with experimental results. The profile changes induced by the current perturbation and central electron heating complicate the analysis and comparison with experiment. (auth)

5731 (IPPJ-183) DENSE RELATIVISTIC ELECTRON PLASMA BY ELECTRON CYCLOTRON HEATING AND ADIABATIC COMPRESSION. Aikawa, H.; Okamura, S.; Hosokawa, M.; Aihara, S.; Alexeff, I. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jan 1974. 13p. NTIS (U. S. Sales Only).

The hot-electron plasma produced by resonant electron cyclotron heating was successfully used as a well-controlled initial phase for a subsequent slow compression experiment. The plasma electron temperature increased almost linearly with an increase of magnetic field up to a compression ratio of over 10 : 1. The initial value was about 10 keV, and the final value was about 110 keV. An important observation was that the compressed plasma appeared to be stable, even when the cold background plasma density decreased dramatically. (auth)

5732 (JAERI-M-5621) SHAPING OF A PLASMA CROSS SECTION BY EXTERNAL CURRENT-CARRYING CONDUCTORS. Shimomura, Y.; Maeda, H.; Kitsunezaki, A.; Yoshikawa, M. (Japan Atomic Energy Research Inst., Tokyo). Mar 1974. 9p. (In Japanese). NTIS (U. S. Sales Only).

Equilibrium configurations were studied numerically of a straight plasma column with various current density profiles in the magnetic field produced by external current-carrying conductors. The intensity of external currents to keep a shape of the plasma cross section is larger when the plasma current concentrates on the magnetic axis than when it diffuses over the plasma cross section. It is thus necessary to control the currents of external conductors in order to keep a suitable shape of the plasma cross section when the plasma current density profiles vary with time. (auth)

5733 (JAERI-M-5649) ANOMALOUS PLASMA LOSS IN THE JAERI TOROIDAL HEXAPOLE. Ohtsuka, H.; Tamura, S.; Nagashima, T.; Shiina, T.; Yamato, H. (Japan Atomic Energy Research Inst., Tokyo). Feb 1974. 12p. NTIS (U. S. Sales Only).

Anomalous plasma loss in the JAERI hexapole was investigated, with emphasis on a field error due to induced wall current and on a support induced convection. The field error produced by the inhomogeneous wall current has no large influence on the plasma confinement. The supports cause plasma loss by way of a convective flow. (auth)

5734 (LA-UR-74-1466) IMPLOSION HEATING STUDIES IN THE SCYLLA 1B, IMPLOSION HEATING, AND STAGED THETA PINCH EXPERIMENTS. Gribble, R. F.; Hammel, J. E.; Henins, I.; Jahoda, F. C.; Kristal, R.; Linford, R. K.; Marshall, J.; McKenna, K. F.; Sherwood, A. R.; Thomas, K. S. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 12p. (CONF-741105-33). Dep. NTIS $4.00.

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Three experiments designed to study various aspects of implosion heating in the plasma density range (10^{14} to 10^{16} cm^{-3}) used in present theta pinches are described. Initial plasma studies show that, provided a sufficiently high preionization level (>10^{14} cm^{-3}) is achieved, plasma behavior is qualitatively the same over a range of two in initial magnetic field use and a range of four in initial gas fill. The implosion phase is characterized by rapid changes in magnetic field diffusion rates, the plasma resistivity decreasing rapidly with time. During the implosion some of the plasma density observed is moving ahead of the magnetic piston. Magnetic field gradients occur in the region outside the area of measurable plasma density implying the presence of hot, low density plasma in this region. In experiments where the external magnetic field decreases before the maximum compression of the plasma column, secondary breakdown occurs at the discharge tube wall which slows the rate at which magnetic flux diffuses out of the discharge tube. (auth)

5735 (ORNL-TM-4661) ALPHA PARTICLE ENERGETICS AND NEUTRAL BEAM HEATING IN TOKAMAK PLASMAS. McAlees, D. G. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 142p. Dep. NTIS $10.25.

Thesis.

The energetic aspects of the 3.5-MeV alpha particles produced in D–T fusion events are examined and physical phenomena which can be expected to occur in future devices containing alphas are predicted. The model of the alpha particle dynamics includes toroidal magnetic field gradient and curvature drifts and motion along the

magnetic field lines. Guiding center motion of alpha particles in various size plasma systems is analyzed. It is shown that finite gyro-radius effects play a basic role in determining alpha particle behavior for feasibility size plasmas (I = 2-5 MA). The alpha particle containment properties for feasibility and reactor size devices are computed. Fast alpha particle distribution functions for the contained alphas are calculated by integrating the source function along the appropriate orbit characteristics numerically. The alpha particle energy density deposition rate profiles, momentum input profiles and the magnitude of electrostatic charging in the background plasma due to alpha particle losses are determined using the distribution functions constructed. A model is developed to determine the energy density deposition rate profiles for neutral beam injection into a tokamak. The heating profiles in the background plasma due to neutral beam injection and alpha particle production are coupled to study the startup of a large CTR reactor. A two-fluid space time computer model is used to simulate the overall plasma behavior. The simulation model includes neoclassical ion conduction, pseudoclassical electron conduction, electron-ion rethermalization, bremsstrahlung and synchrotron radiation, ohmic heating, alpha particle and neutral beam heating terms. Questions of beam energy deposition profiles, energy requirements for neutral penetration into the plasma, and beam power required to achieve ignition or prescribed heatup rates are examined. The analysis is primarily for the 5000 MW(th) conceptual fusion reactor UWMAK-I studied by the University of Wisconsin. Typically, beam energies of several hundred kilovolts and powers of ~50 MW provide adequate penetration and ignition times in the range of 2 to 10 seconds. The sensitivities of the time required to achieve ignition and resulting heatup rates to changes in injection energy (100 to 500 keV) and beam power (10 to 75 MW) are also determined. (MOW)

5736 OHMIC HEATING IGNITION OF TOKAMAK DEVICES. Kammash, T.; Galbraith, D. L. (University of Michigan, Ann Arbor). Trans. Amer. Nucl. Soc.; 19: 10-11(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5737 MAGNETOHYDRODYNAMIC BEHAVIOR OF A LASER-HEATED SOLENOID. Burnett, N. H.; Offenberger, A. A. (Univ. of Alberta, Edmonton). J. Appl. Phys.; 45: No. 5, 2155-2162 (May 1974).

The problem of laser-induced heating and radial expansion of a low density plasma in a solenoidal magnetic field has been examined by means of a Lagrangian computer code incorporating an exact solution of the relevant MHD equations plus thermal conduction. It is shown that for long-term heating with a realistic range of laser power and magnetic field strength, the resulting radial temperature and density profiles can be closely approximated by a quasistatic solution of these equations. (auth)

5738 EXPERIMENTAL STUDY OF IGNITION AND PROPAGATION OF LASER-SUPPORTED DETONATION WAVES. Maher, W. E.; Hall, R. B.; Johnson, R. R. (Boeing Aerospace Co., Seattle). J. Appl. Phys.; 45: No. 5, 2138-2145(May 1974).

Laser-supported detonation waves were studied with 15-J 56-MW/cm^2 laser pulses from a CO_2 Marx Bank laser. A smooth spatial and temporal laser beam profile was repeatable from pulse to pulse. Ignition thresholds for laser-supported detonation waves were determined from relative reflected power and from framing camera photographs for many solid and liquid surfaces. Some of these thresholds were measured as functions of density of the medium (air) from 0.01 to 1 times atmospheric density. The velocities of laser-supported detonation waves were studied to determine their dependence on laser beam intensity and medium density for conditions above the ignition thresholds of aluminum and lead surfaces. Streak camera photographs displayed clearly defined wavefronts whose initial velocities were constant until they were affected by decreasing laser beam intensities. When the temporal intensity changes in the beam and its focused geometry are included in calculations using the Raizer model for laser-supported detonation waves to predict the wavefront motion, excellent agreement with the streak camera photographs was found. The initial velocity data are shown to agree with a power law in which velocity is proportional to (intensity/medium density)$^{0.41 \pm 0.02}$. No explanation is proposed for the difference of the power law exponent from the $\frac{1}{3}$ value predicted by the Raizer model. (auth)

Diagnostics

5739 (EUR-CEA-FC-728) NEUTRAL DENSITY DETERMINATION BY SCATTERING OF VACUUM-UV RADIATION. Breton, C.; Papoular, R. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). [nd]. 26p. Dep. NTIS (US Sales Only) $4.50.

A method was developed for measuring the density of neutral hydrogen atoms from the scattering of resonant uv radiation. The method enables low densities (of the order of a few 10^8 cm^{-3}) to be detected with a spatial resolution of 1 cm. The apparatus necessary is simple and reliable. In addition to fusion machine applications, the method can be used for other particles provided that they exhibit transitions in the same spectral band, e.g., impurities. (FR)

5740 DETERMINATION OF THE DENSITY AND ENERGY SPECTRA OF THE PLEIADE PLASMA FROM OPTICAL DOPPLER SHIFT MEASUREMENTS. Hesse, M.; Moulin, B.; Stevenin, P. (CEN, Grenoble, France). Compt. Rend., Ser. B; 278: No. 10, 401-404(4 Mar 1974). (In French).

A Doppler shift method was used to evaluate the energy and density of a proton beam, charge exchange reactions with excitation of ions on a gas target being used for this purpose. The spectra and energy of the beam were deduced from the shift and broadening exhibited by the de-excitation line. The absolute calibration of the γ-ray detector counting unit enabled the ion density of the beam to be determined. (FR)

5741 METODY DIAGNOSTIKI VYSOKO-TEMPERATURNOI PLAZMY. (Methods for the Analysis of High-Temperature Plasmas). Kuznetsov, E. I.; Shcheglov, D. A. Moscow; Atomizdat (1974). 160p.

A series of questions connected with the contactless methods for plasma diagnosis are examined. Problems of the measurement of the basic parameters of high-temperature plasma are analyzed from the viewpoint of the selection of the optimum experimental set-up. Special attention is given to obtaining the spatial distribution of the plasma parameters from integral measurements and measurements of local characteristics. Methods for the study of the electric and magnetic fields in plasmas and the study of their material and energy balance are examined. Examples are given of the use of specific methods on specific experimental plasma installations. Methods for the processing and interpretation of experimental data and particularly questions on the automatic computer processing of data are discussed. (tr-auth)

Kinetics (General)

5742 (DEU-73-4) RESEARCH REPORT 1971. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Plasmaforschung). 1972. 74p. (In German).

The report contains the results and present research in the following fields: heating of plasma, wave propagation, plasma flow, plasma focus, interaction of electric and magnetic fields with shock waves, short-pulse diagnostics and laser applications. (GE)

5743 (UCID-16188) AUTO-ACCELERATION. Briggs, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 Jan 1973. 7p. Dep. NTIS $4.00.

The electron beam from a pulsed diode, with a current waveform lasting 10 to 50 nanoseconds, is focused by a solenoidal magnetic field and passes through a fin-loaded waveguide. The focusing possibilities are briefly discussed. (MOW)

5744 (UCID-16199) COMMENTS ON AUTO-ACCELERATION. Smith, L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Jan 1973. Contract W-7405-eng-48. 11p. Dep. NTIS $4.00.

The Ohmic losses of an electron bunch in a metallic pipe wall are calculated. The loss was calculated for a smooth conducting pipe and factors were considered in order to account for fins, cavities, and other materials. Some remarks on solenoidal focusing are given for the cases of space charge and no space charge. (MOW)

5745 (UCID-16597) DEFLECTION OF A HIGH CURRENT RELATIVISTIC ELECTRON BEAM BY A WEAK MAGNETIC FIELD IN THE PRESENCE OF PLASMA. Hester, R. E.; Lamb, W.; Lauer, E.; Spoerlein, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Sep 1974. Contract W-7405-eng-48. 12p. Dep. NTIS $4.00.

The beam was deflected by magnetic fields varying from 0.3 to 3.64 gauss. This is to be compared to the self-field of 16 gauss at the radius of 4 cm dia. 160 A beam. Differences of 10 to 20% were observed between predicted and measured values of beam deflection. This is within range of expected experimental

errors. The largest errors are probably due to small changes in accelerator conditions over the time required to record data and the fact that the resolution of the measuring technique is marginal. However, the experiment demonstrates that no large differences between theory and experiment exist. Experiments where discrepencies exist may be influenced by beam interaction with metal walls. (auth)

5746 ION TEMPERATURE EFFECTS IN TWO-COMPONENT SYSTEMS. Towner, H. H.; Miley, G. H. (Univ. of Illinois, Urbana). Trans. Amer. Nucl. Soc.; 19: 11-12(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5747 PLASMA PHYSICS AND SOLAR RADIOASTRONOMY. I. Proceedings of the Summer School, Ile de Re, France, September 4-19, 1972. Mangeney, A. (ed.). Meudon, France; Observatoire de Paris-Meudon (1974). 363p. (CONF-7209119-).

The following topics are discussed: (1) kinetic theory of plasma, (2) plasma instabilities, (3) neutral point phenomena, (4) collisionless shock waves, (5) weak turbulence, (6) physical characteristics of the solar atmosphere, (7) coronal structures, (8) shock waves and related radio bursts, (9) periodicities in solar radio bursts, (10) fine structure in spectra of solar radio bursts, (11) fine structure at meter and decameter wavelengths, (12) intensity decrease of microwave bursts correlated with type II meter emission, (13) nonlinear effects in solar meter radiation, (14) parametric wave interaction in magnetized plasma, (15) type III radiobursts, (16) coronal scattering, and (17) type I solar radio emission. (MOW)

5748 CURRENT LIMITING BY SELF MAGNETIC FIELD IN A PLASMA ACCELERATOR. Korsun, A. G. Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 1, 124-126(Jul 1974).

Translated from Zr. Tekh. Fiz.; 44: No. 1, 202-206(Jan 1974).

A study is made of the stationary flow in a coaxial accelerator in which plasma is supplied from the end face of the central electrode. If the discharge current is large a plasma jet is formed in the interelectrode space as a result of the pinch effect. The jet is compressed with increasing current strength and detaches from the outer electrode at a certain limiting current. (auth)

5749 PROBLEM OF MEASURING THE IONIZATION VELOCITY IN PLASMA. Sobol, A. G.; Sobol, G. A. (Lvov Polytechnical Inst.). Izv. Vyssh. Ucheb. Zaved., Radiofiz.; 17: No. 7, 1085-1088(1974). (In Russian).

A one-zone and a two-zone method were previously proposed for the measurement of the ionization rate in plasma. Formulas were derived for the description of the ionization frequency and rate in the one-zone and two-zone case in a plasma of Ar or Ne. The measurement results obtained for the case of Ne are tabulated and show fairly good agreement with results obtained by the usual probe measurements. (JSR)

5750 DYNAMICS AND EMISSION OF COAXIAL PLASMA SHELLS IN AIR. Aleksandrov, A. F.; Perebeinos, V. V.; Savichev, A. T.; Timofeev, I. B. (Moscow State Univ.). Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 1, 38-42(Jul 1974).

Translated from Zh. Tekh. Fiz.; 44: No. 1, 65-72(Jan 1974).

An experimental study was made of the dynamics and radiation of high-current pulsed discharges (at currents up to ~300 kA) with return currents up to 100 cm long. These return currents are produced by the electrical explosion of many wires arranged along the generatrices of a cylinder in air. A study was made of the dynamics of contracting, expanding, and steady-state plasma shells. In none of the experiments do individual discharge channels formed by the explosion of each wire coalesce into a single current shell. The characteristic dimensions and temperatures and the radiation emitted in various spectral ranges were determined. Such discharges convert electrical energy into radiation efficiently. (auth)

5751 IONY I VOZBUZHDENNYE ATOMY V PLAZME. (Ions and Excited Atoms in a Plasma). Smirnov, B. M. Moscow; Atomizdat (1974). 456p.

This book considers the properties of ions and excited atoms, their modes of formation in a plasma, and also the diffusion and mobility of the ions and excited atoms. Moreover a study is made on the chemical transformations of ions and excited atoms taking place during collisions with atomic particles: processes of the formation of molecules and complex ions during ternary collisions, the recombination of positive ions with electrons and negative ions, the sticking of an electron to a molecule and the destruction of a negative ion on collision with an atom or molecule, ion-molecular reactions, processes of the destruction of excited atom, etc. The book contains and analyzes the results of a large number of experimental studies on these problems, describes the theoretical methods of investigating this circle of problems, and presents the results. (99 tables, 121 figures, 1697 references) (SJR)

Kinetics (Experimental)

5752 (IPPJ-179) OBSERVATION OF STATIONARY SHOCK-LIKE STRUCTURE AND ENHANCED DIFFUSION IN A TOROIDAL PLASMA. Mohri, A.; Fujiwara, M. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Nov 1973. 20p. NTIS (U. S. Sales Only).

Electrons are injected into an afterglow plasma confined in a l = 3 stellarator to raise the poloidal rotational velocity. A steady shock-like structure characterized by a steep density gradient is observed near a critical rotational speed. A strong enhancement of diffusion rate occurs at higher radial electric field, accompanying with large amplitude density fluctuations. Vortices are generated at three corners of the triangular magnetic surfaces when the radial electric field turns over as going to the periphery. (auth)

5753 (LGI/R/PLAD-73.10/E) INVESTIGATION ON THE X-RAY EMISSION FROM THE PLASMA FOCUS MACHINES. Merolli, S.; Pelliccioni, M.; Samuelli, M. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati). Oct 1973. 14p. Dep. NTIS (US Sales Only) $4.00.

Measurements of x-ray emission of about 100 keV from the two plasma focus machines operating at Frascati (a Filippov and a Mather-type machine) are reported. Both the average energy and the absolute yield were determined when the two machines operated at the same initial voltage as the capacitor bank (32 keV). (auth)

Kinetics (Theoretical)

5754 (COO-2200-5) NUMERICAL SIMULATIONS OF PLASMAS WITH SMOOTHING IN PHASE SPACE AND FILTERING IN TIME. Progress Report, October 1, 1973-September 30, 1974. Denavit, J. (Northwestern Univ., Evanston, Ill. (USA)). 1974. Contract AT(11-1)-2200. 11p. Dep. NTIS $4.00.

The research is directed toward the development and testing of new numerical methods for plasma simulation and their application to physical problems of current interest in controlled thermonuclear research. During the past year, research on the project has been concerned with the following specific problems: (1) Computer simulations of whistler wave propagation were carried out using a particle code developed earlier in the program. These computations have shown the existence of a whistler sideband instability and of secondary emissions from large-amplitude wavepackets caused by phase-correlated electrons. (2) The study of particle-pushing algorithms applicable on a time scale larger than ω_{pe}^{-1} has been continued. Such an algorithm was tested on simple problems such as Landau damping and the trapping of an energetic electron beam. (3) A code to simulate collisional effects in plasmas was developed and applied to the study of weak collisional effects in anomalous absorption and heating. This code is based on a one-dimensional Fokker-Planck operator and allows a velocity dependence of the collision frequency. (4) Fluid codes were developed to compute the dynamics of one- and two-dimensional Langmuir solitons. Plane and annular solitons were shown to be unstable to perturbations in the transverse direction and the collapse of annular solitons in the azimuthal direction is faster than their radial collapse. (auth)

5755 (COO-2200-6) SIMULATION OF COLLISIONAL EFFECTS IN PLASMAS. Rathmann, C. E.; Denavit, J. (Northwestern Univ., Evanston, Ill. (USA)). 30 Oct 1974. Contract AT(11-1)-2200. 39p. Dep. NTIS $5.00.

A computer simulation method was developed to simulate collisional effects in plasmas in the regime where plasma instabilities are dominant but are modified by weak collisions. The algorithm is based on the method of periodic smoothing in phase space, in which collisions are introduced at reconstruction times in terms of a one-dimensional Fokker-Planck operator with a velocity dependent collision frequency. The results of test problems, including approach to equilibrium, collisional heating and plasma echo decay, are presented. (auth)

5756 (ITF-74-94P) SPECTRAL DENSITIES OF THE SPATIAL CHARGE CORRELATIONS IN THE PLANE LAYER OF BIMAXWELLIAN ELECTRON-ION PLASMA. Popov, V. S.; Yakimenko, I. P. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The electromagnetic fluctuations were considered for the case of electron-ion plasma bounded by the two parallel planes under the circumstance that the condition of the specular reflection of charged particles is satisfied. The boundary value problem for the

fluctuational field in such a system was solved and then the correlation functions for the fluctuations of electron and ion charge were found. The special cases of electron and Maxwellian electron-ion plasmas were investigated. The main attention was paid for the frequency domains in which plasma is transparent. In such domains the fluctuations have the wave nature and the influence of boundaries is essential in the total plasma region. (auth)

5757 (LGI/R/TEO-73.3/E) NEOCLASSICAL THEORY OF COLLISIONAL TRANSPORT IN THE PRESENCE OF FUSION α-PARTICLES. Nocentini, A.; Tessarotto, M.; Engelmann, F. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati). Jul 1973. 72p. Dep. NTIS (US Sales Only) $6.75.

The neoclassical transport theory was developed for a toroidal plasma containing highly energetic α-particles produced by fusion events. It is shown that the α-particle fluxes in this case have a weaker dependence on the aspect ratio than at lower energies, due to the fact that the prevailing collisional effect is a drag. (auth)

5758 (LGI.R/TEO-73.11/E) NON-AXISYMMETRIC EQUILIBRIA IN TOKAMAKS AND OHMICALLY-HEATED STELLARATORS. Lo Surdo, C.; Sestero, A. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas. Ionizzati). Oct 1973. 28p. Dep. NTIS (US Sales Only) $4.50.

An asymptotic expansion scheme is set up which is appropriate to deal with the deviations from axisymmetry occurring in Tokamaks and ohmically-heated Stellarators. Solutions of the MHD equilibrium equations are sought to all orders in the expansion parameter, which is related both to the magnitude of the deviations from axisymmetry and to the ratio of poloidal vs toroidal components of current and magnetic field. The existence of a solution beyond the lowest significant order can be established if the asymmetries are such as to verify certain constraints. It is seen that the main causes of asymmetry in Tokamaks and Stellarators (the ripples in the toroidal field, the gaps in the copper shell, and the helical windings) all verify these constraints, which is consistent with the good evidence of equilibrium that is obtained in the experiments. Other types of deviations from axisymmetry can, however, lead to rather poor equilibria, namely, equilibria existing only to lowest significant order. (auth)

5759 (UCID-16116) DESCRIPTION OF PROGRAM BEAMSIM. Leary, J. M.; Lee, E. P.; Bolstad, J. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Aug 1972. Contract W-7405-eng-48. 106p. Dep. NTIS $8.50.

A computer simulation program was developed at Lawrence Livermore Laboratory to aid in understanding relativistic electron beam propagation experiments. Some phenomena which have been studied are hose instability into the nonlinear regime, sausage instability, beam equilibria, and beam expansion from multiple scattering. The beam is injected at z = 0 into a tank of H_2 gas and propagates in the +z-direction at the speed of light. The particle betatron motion is in the r, θ plane and is governed by the Lorentz force law. Maxwell's field equations reduce to a set of essentially uncoupled diffusion equations at each z in the z-component of the vector potential $\partial A/\partial\xi = J/\sigma + c/4\pi\sigma\,\Delta A$. Here Ohm's law is $J = \sigma E$ and ξ = distance back from the beam head ($\xi = ct - z$). The θ-dependence of A is Fourier decomposed and the resulting diffusion equations form a tridiagonal system of linear equations. The program produces graphical and printed output of current density, vector potential and conductivity vs r; center of mass and beam radius vs z and ξ; and (r,θ) cross sections of the beam. The program is written in CHAT (local extended FORTRAN) and runs on the CDC-6600 and -7600 computers. (auth)

5760 (UCRL-51616) ISOTIONS: A ONE-DIMENSIONAL MULTISPECIES FOKKER–PLANCK COMPUTER CODE. Mirin, A. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Jul 1974. Contract W-7405-eng-48. 102p. Dep. NTIS $5.45.

Program ISOTIONS solves the time-dependent isotropic Fokker–Planck equation for an arbitrary number of ion species and one electron species. Each species is assumed to be represented by the first normal mode. An implicit difference algorithm, which is first order accurate in time and either first or second order accurate in space, is used to advance the solution. The velocity finite difference mesh usually consists of 1001 points (not necessarily uniformly spaced). The field length for a typical three-species calculation is approximately $400{,}000_s$, and the running time is approximately 10 minutes (depending of course on the number of time steps). The code operates without disk files or tapes. The necessary input consists merely of data cards. Both CRT plots and printed data (HSP/FICHE and OLP) make up the output. (auth)

5761 EFFECT OF ION–MOLECULE REACTIONS ON THE IONIZATION EQUILIBRIUM IN A TWO-TEMPERATURE PLASMA. Polak, L. S.; Slovetskii, D. I. (Inst. of Petrochemical Synthesis, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 8: No. 2, 112-116(1974).

Translated from Khim. Vys. Energ.; 8: No. 2, 135-140(1974).

It is shown theoretically that in a two-temperature plasma (where the electron temperature exceeds the temperature of the heavy particles) a shift in the equilibrium of the ion–molecule reactions causes a divergence of the concentrations of electrons and excited atoms from the equilibrium values calculated from the equations of Saha and Boltzmann for $T_e = T_a$, even if transitions between excited levels of atoms and the continuum are caused only by collisions with electrons. (auth)

5762 CALCULATION OF SOME CHARACTERISTICS OF PLASMA JETS DRIFTED BY GAS FLOW. Parkhomenko, V. D.; Soroka, P. I.; Ganz, S. N. (Dnepropetrovskij Khimiko-Tekhnologicheskij Inst. (Ukrainian SSR)). Teor. Osn. Khim. Tekhnol.; 8: No. 1, 60-65(Jan 1974). (In Russian).

For English translation see the journal Teor. Found. Chem. Eng.

On the basis of experimental data an equation was derived for the trajectory of the axis and range of the plasma jet in a drifted gas current. The boundaries of the zone of mixing of the plasma jet with the surrounding medium were calculated. It was shown that the width of the boundary layer depended on the physical properties of the plasma-forming gas and was practically independent of the initial heating of the jet and the drifted flow. (tr-auth)

5763 BASIC PRINCIPLES OF PLASMA PHYSICS: A STATISTICAL APPROACH. Ichimaru, S. Frontiers in Physics. Reading, PA; Addison-Wesley/W. A. Benjamin, Inc. (1973). 342p. $19.50.

The following chapters are included: (1) kinetic equations, (2) plasmas as dielectric media, (3) longitudinal properties of a plasma in thermodynamic equilibrium, (4) transverse properties of a plasma in thermodynamic equilibrium, (5) transient processes, (6) instabilities in homogeneous plasma, (7) instabilities in inhomogeneous plasma, (8) fluctuations, (9) relaxation processes, and (10) plasma turbulence. (MOW)

5764 INTERACTION OF A PLASMA FLOW WITH A MAGNETIC DIPOLE FIELD. Oberth, R. C. (Technische Univ., Munich). Phys. Fluids; 17: No. 3, 566-574(Mar 1974).

The interaction of a streaming plasma with a magnetic dipole field is studied in the framework of a linearized, two-fluid continuum description. For the case of low-density flows, in which the pressure gradients are small in comparison to magnetic and electric forces, it is possible to extend the solution beyond the first-order one, which gives the distribution of induced current in the azimuthal direction, and calculate space-charge density and plasma potential distributions, along with the Hall current components in a restricted spatial region. The quantities of second-order scale directly with the appropriate Cowling number, whereas the azimuthal current density increases with the square root of this ratio. It is also shown that the Hall current densities and potential variation increase rapidly with increasing plasma density, while the normalized space charge density scales with the square of the plasma velocity. Moreover, the theory predicts a significant decrease in plasma potential in the vicinity of the dipole; a result which tends to agree with recent experimental indications. (auth)

Production

Refer also to abstract 5861.

5765 (SAND-74-0233) LASER PLASMA ENERGY ABSORPTION. Mendel, C. W. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 31p. Dep. NTIS $4.75.

A simple measurement of the total energy absorbed in ionized plasma is made by entrapping the plasma in a cusped magnetic field. The laser used was an 0.5 to 3 joule, 100 nsec CO_2 TEA laser. The focal spot was 0.5 mm in diameter. Thin aluminum foils with graphite coatings were used as targets. The plasma was found to contain only 10% of the laser energy. The effect of the energy needed to dissociate the target was clearly discernible. (auth)

5766 (SAND-74-5573) SPECTRAL MEASUREMENTS OF HOT ELECTRONS FROM LASER-PRODUCED PLASMAS. Cano,

G. L.; Brannon, P. J.; Powell, J. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 10p. Dep. NTIS $4.00.

Spectral measurements were made of electrons emanating from CD_2 and LiD plasmas produced in the multiple-beam laser experiments at Sandia Laboratories. Spherical CD_2, LiD, and LiDT pellets were irradiated in a tetrahedral geometry with energies up to 50 J/beam in one nsec from a Nd: glass laser system. The electron spectral measurements were done with a magnetic spectrometer in the energy range 50-160 keV. The spectra obtained are a monotonically decreasing function of intensity with increase in kinetic energy. (auth)

5767 (UCID-16193) SUPERTHERMAL ELECTRON X-RAY EMISSION IN LASER PLASMAS. Bailey, D. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Jan 1973. Contract W-7405-eng-48. 36p. Dep. NTIS $5.00.

As a guide to experimental determination of the amount of superthermal electrons generated in laser plasmas, the current theoretical predictions of ns scale laser pulses on slab targets are presented. For both one and two dimensional cases, the x ray emission above 20 keV should clearly show nonthermal electron effects. (auth)

5768 FUNDAMENTAL AND APPLIED LASER PHYSICS. Proceedings of the Symposium Held at Esfahan, Iran, August 29 to September 5, 1971. Feld, M. S.; Javan, A.; Kurnit, N. A. (eds.). New York; John Wiley and Sons, Inc. (1973). 960p. (CONF-710826-). $27.50.

Topics covered include nonlinear optics, the generation of intense short pulses and their applications to such areas as plasma production for x-ray generation and controlled thermonuclear reactions, precision spectroscopy using nonlinear saturation techniques, tunable lasers for spectroscopy, Raman and Brillouin scattering, chemical lasers and the application of lasers to the study of chemical processes, measurements of wavelength and optical frequencies, length and time standards, transient coherent phenomena, novel laser mechanisms, and integrated optics. In addition, recent progress in the closely related fields of optical pumping masers, and astronomical sources is reviewed. The articles have been updated to include recent advances. Predictions of important developments in quantum electronics in the next decade are given by a panel of distinguished experts. (MOW)

5769 LAWRENCE LIVERMORE LABORATORY LASER FUSION PROGRAM OVERVIEW. Swingle, J. C. (Univ. of California, Livermore). Trans. Amer. Nucl. Soc.; 19: 2(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5770 LAZERNAYA ISKRA I RASPROSTRANENIE RAZRYADOV. (Laser Sparks and Discharge Propagation). Raizer, Yu. P. Moscow; Izdatel'stvo Nauka (1974). 308p.

The breakdown of gases by laser radiation and the effects of propagation of plasma fronts are considered. A theory of development of an electron avalanche under the action of optical and super-high-frequency fields is presented. An approach to the problem of maintaining a plasma in electromagnetic fields is formulated. The phenomena of "light detonation," of "burning" of a light beam, and of the interaction of an arc and a plasma are considered. Many basic problems of the physics of the interaction of ionized gas with an electromagnetic field are studied. The book is designed for scientists, engineering and industrial workers, and undergraduate and graduate students. (tr-auth)

5771 LASER-TARGET INTERACTIONS. Hoffman, C. G. (Los Alamos Scientific Lab., NM). J. Appl. Phys.; 45: No. 5, 2125-2128(May 1974).

Metallographic and microscopic techniques were applied to the study of laser targets of various materials. Optical microscopy and scanning electron microscopy of foils and wires that had been irradiated by a 10-J laser (wavelength 1.06 μm) were followed by sectioning through the holes both longitudinally and transversely. Foils of gold and titanium show considerable melting and splatter on the front surface, a hole through the foil, and spalling from the rear surface. Polyethylene shows tensile fracture on the front surface, clouds of large and very small bubbles around the hole near the entering surface, and evidence of the ejection of molten material from the rear surface. In addition, a lenticular void appears near the center of the film. Gold wires, in addition to being ruptured, show a lanceolate void along the axis of the wire extending to well outside the supposed area of influence. As yet only hypotheses for this behavior exist. (auth)

Stability

Refer also to abstract 5836.

5772 (JAERI-M-5583) MHD STABILITY OF BELT-PINCH TYPE PLASMAS. Wakatani, M. (Japan Atomic Energy Research Inst., Tokyo). Feb 1974. 18p. NTIS (U. S. Sales Only).

The stability of kink-like modes in the toroidal plasmas with hollow cylindrical geometry was studied by means of their growth rate. The configurations simulate the tokamak with noncircular cross section elongated vertically or the "Belt-Pinch" type configuration. It is possible to increase the current in the toroidal plasmas of noncircular cross section with large axial length. The stability properties, however, are similar to those in the cylindrical plasma column. (auth)

5773 (JAERI-M-5612) EQUILIBRIUM AND LOCALIZED INSTABILITY OF JFT-2a. 1. Flat Current Distribution. Kitsunezaki, A.; Shimomura, Y.; Maeda, H.; Yoshikawa, M. (Japan Atomic Energy Research Inst., Tokyo). Mar 1974. 38p. (In Japanese). NTIS (U. S. Sales Only).

Equilibrium and localized instability of the JFT-2a (DIVA) plasma were studied numerically. JFT-2a is designed to examine the noncircular (tear drop) cross section tokamak and an axisymmetric divertor. A sectional form of the device is chosen to allow installation of the divertor and to enhance plasma stability. The computer code to calculate equilibrium values and examine localized instability criteria is described. Some results shown were obtained with the equilibrium solution of a special form in the plasma to apply a new method of calculating the vacuum magnetic field outside the plasma. Another computer code for vacuum magnetic field calculation and the results obtained with it are also described. (auth)

5774 (LGI.R/TEO-73.13/E) STABILIZATION OF THE TRAPPED-ION DISSIPATIVE INSTABILITY BY IMPURITIES. Dobrowolny, M. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati). Nov 1973. 32p. Dep. NTIS (US Sales Only) $4.75.

The influence of impurities on the trapped-ion dissipative instability is extensively investigated. It is found that impurities lead to most significant stabilizing effects on the dissipative modes on trapped ions. In particular, when the impurity ions are in the banana regime, sufficient conditions for complete stabilization of the instability have been found, in the case of sharp impurity density gradients of both signs. When these conditions are not satisfied, one finds nevertheless a noticeable shrinking of the range of unstable wave numbers upon increasing impurity concentration. These features were discussed quantitatively, in terms of the impurity parameters, both with reference to present day experiments and for future experiments with reduced impurity levels. (auth)

5775 TEMPERATURE-DENSITY STABILITY IN TOKAMAK REACTORS. Stacey, W. M. Jr. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 14-15(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5776 ELECTROSTATIC ION CYCLOTRON INSTABILITY DUE TO AN ION BEAM IN A PLASMA. Ishizuka, Hiroshi; Ono, Hisao; Kojima, Shoji (Tokyo Univ. of Education (Japan). Faculty of Science). J. Phys. Soc. Jap.; 36: No. 4, 1158-1163(Apr 1974).

Experiments were carried out in which a 3-5 keV helium ion beam was injected into a low-density helium plasma along a pulsed magnetic field. Low-frequency waves growing in the direction of the beam flow were observed for the magnetic field strengths of 300-2000 G, which were characterized by the oscillation frequency in excess of the ion cyclotron frequency but less than the ion plasma frequency. The wave mode was axisymmetric and the radial wavenumber was much larger than the axial one. Axial wavelength measurements on launched waves suggested that the phase velocity of the growing wave was nearly equal to the ion beam velocity. Most of the experimental results were found to be consistent with a simplified theory of electrostatic ion cyclotron instability in a slow-beam plasma system, which however predicted larger growth rate than that measured. (auth)

5777 INSTABILITIES AND GROWTH RATES OF LOW SHEAR GUIDING CENTER PLASMA PINCHES. Pao, Y. P. (New York Univ., NY). Contract AT(11-1)-3077. Phys. Fluids; 17: No. 3, 600-603(Mar 1974).

Some instabilities and their growth rates are examined for low shear guiding center plasma pinches. Relations between these instabilities and the Suydam-type instability are also discussed in terms of their growth rates. (auth)

5778 NONLINEAR STABILIZATION AND NONRANDOM BEHAVIOR OF MACROINSTABILITIES IN PLASMAS. I. Theory. Sato, T. (Max-Planck-Institut fuer Physik und Astrophysik, Garching, Ger.). Phys. Fluids; 17: No. 3, 621-627(Mar 1974).

Nonlinear mass transport associated with the Hall motion of particles coherent with a wave field is studied for electrostatic

instabilities, which are described by the magnetohydrodynamic equations. It is shown that the nonlinear transport causes a modification of the density distribution and/or the drift velocity, leading to stabilization of the unstable waves in both cases. It is also shown that fluid elements (particles) move in the Hall direction in a nonrandom manner under the action of a coherent wave electric field. Consequently, the density distribution is modified in an oscillatory way, thus giving rise to a modulation in amplitude. (auth)

5779 NONLINEAR STABILIZATION AND NONRANDOM BEHAVIOR OF MACROINSTABILITIES IN PLASMAS. II. Numerical Verification. Sato, T. (Max-Planck-Institut fuer Physik und Astrophysik, Garching, Ger.); Ogawa, T. Phys. Fluids; 17: No. 3, 628-633(Mar 1974).

To verify the nonlinear theory of electrostatic macroinstabilities in magnetized plasmas, with special emphasis on the amplitude oscillation, numerical calculations were made for a two-dimensional, weakly ionized plasma with a density gradient and crossed electric and magnetic fields (cross-field instability), which is found to be a suitable plasma to yield an amplitude oscillation. It is shown that, on the average, the unstable mode is stabilized by the reduction of the density gradient but, in detail, exhibits an oscillation in amplitude in conjunction with oscillation in density and potential distributions. It is also shown that nonlinear higher modes excited by the dominant mode suffer strong amplitude oscillations. Theoretical interpretation of such strong amplitude oscillations is considered. (auth)

5780 CURRENT-DRIVEN COLLISIONAL DRIFT INSTABILITY. Ellis, R. F.; Motley, R. W. (Princeton Univ., NJ). Phys. Fluids; 17: No. 3, 582-594(Mar 1974).

An experimental and theoretical study of the current-driven collisional drift instability is reported. This very strong [$\mathrm{Im}(\omega) \sim \mathrm{Re}(\omega)$], low-frequency ($\omega \ll \Omega_i$) instability was observed in a current-carrying collision dominated, cesium plasma. Positive instability identification is based on a detailed comparison of experimental wave parameters with a linearized two-fluid theory which includes the effects of electron heat flow, electron temperature fluctuations, parallel resistivity, finite ion Larmor radius and transverse ion viscosity. Theory and experiment are in agreement on: (1) the strong destabilizing effect of axial current; (2) the magnitude of the instability frequency and its parametric dependence on magnetic field, azimuthal mode number, and axial current; (3) the qualitative features of the axial structure and their variation with axial current; (4) the magnitude of the critical current for excitation and its variation with magnetic field and density; (5) the relative stability of the different azimuthal modes; (6) the variation with current, magnetic field, and density of the relations between fluctuating density and fluctuating floating potential. In addition, large wave induced plasma losses occurring with instability onset could be explained on the basis of the measured wave parameters. (auth)

5781 TRANSVERSE DYNAMIC STABILIZATION OF A SCREW PINCH. Lister, G. G.; Troyon, F. S.; Weibel, E. S. (Centre de Recherches en Physique des Plasmas, Lausanne, Switzerland). Phys. Fluids; 17: No. 3, 660-661(Mar 1974).

An oscillating axial current can stabilize a weak screw pinch ($B_\theta \ll B_z$). The minimum aspect ratio for a stabilized toroidal screw pinch is the same as for a dynamically equilibrated theta pinch. (auth)

Thermonuclear Engineering and Equipment

Refer also to abstract 5862.

5782 (AECL-4840) REVIEW OF THE PROSPECTS FOR LASER INDUCED THERMONUCLEAR FUSION. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1974. 218p. Dep. NTIS (US Sales Only) $14.00.

The report is basically a review and contains the texts of verbal presentations to the AECL Senior Management Committee. Appendices which give a historical background and enlarge upon several technical aspects of laser fusion are included. (auth)

5783 (ANCR-1176) POSSIBILITIES OF NEUTRON SOURCES AT NRTS FOR CTR MATERIALS TESTING. Brugger, R. M. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Aug 1974. Contract AT(10-1)-1375. 17p. Dep. NTIS $4.00.

This document is one of several descriptions how the NRTS has contributed to the USA's fission reactor development program and how the NRTS can contribute to the USA's fusion reactor development program. This document describes neutron sources that can be used for materials damage studies of CTR materials and how these can be developed and applied at the NRTS. The first section briefly outlines the need for such sources in the fusion program. The second section describes how the NRTS was the nation's center for radiation sources used for materials damage studies for all types of fission reactors. The third section suggests CTR radiation sources and how these would fit into facilities at the NRTS. (auth)

5784 (BNL-19351) SYNTHETIC FUELS FROM FUSION REACTORS. Powell, J. R.; Salzano, F. J.; Sevian, W.; Bezler, P. (Brookhaven National Lab., Upton, N. Y. (USA)). [nd]. 12p. Dep. NTIS $4.00.

The technical, environmental and economic features of a synthetic fuels economy based on fusion reactors are evaluated. Analyses of alternate possible U. S. energy systems for 2020 AD indicate that CTR's can deliver synthetic fuels based on electrolytic hydrogen (H_2 gas, H_2 liquid and methanol) at costs competitive with natural fossil fuels and synthetic fuels derived from coal. With less conservative CTR and synthetic fuel production technology, CTR-derived synthetic fuels should be substantially cheaper than fossil fuels. A synthetic fuels economy based on CTR's has substantial environmental benefits, including much lower chemical and radioactive emissions and the elimination of strip mining. The effect of various tokamak reactor parameters is examined, including q, β_0, first wall loading, reactor size, and fuel cycle. Large reactor sizes appear feasible, up to 20 GW(e) electrical, because of the larger market and larger transmission distances with synthetic fuels. The DD fuel cycle yields production costs comparable to those using DT fuel. (auth)

5785 (EUR-CEA-FC-730(Pt.1)) ANNUAL PROGRESS REPORT OF THE FONTENAY-AUX-ROSES RESEARCH GROUP, JANUARY 1 TO DECEMBER 31, 1973. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). [nd]. 114p. (In French). Dep. NTIS (US Sales Only) $8.75.

The research carried out in the field of ionized gas theory is presented, i.e., MHD equilibrium and stability, behavior of Tokamak plasmas, waves, transport and convection, spectroscopy, and structure and function of toroidal machines. The fundamental physics part of the research carried out can be divided into the following sections: microwave frequency diagnostics, beam-plasma interaction, EOS-POP experiments, effect of impurities on non-collisional drift, Stark broadening of HeI plasma lines, HCN laser, resonant diffusion of light, generation of temporal echos in DECA II B, atomic collisions, and cross section calculations. The Sagittaire project (which followed the Bille-en-Tete B experiment) occupied most of the work on open configurations. At least one third of the development part of the Department was concerned with studying methods of heating plasmas for future experiments (Petula and Wega, injection of neutral particles in TFR's, heating in the ion cyclotron range, and granion injection (INGRA)) and with the development of ion sources. The most interesting events of the year took place at the TFR during the three months successful operation prior to the vacuum chamber leak. It is envisaged that future research will be orientated towards the J.E.T. (Joint European Torus) project. (FR)

5786 (IPPJ-DT-31) STUDY ON MANUFACTURING TECHNOLOGY IN PLASMA PHYSICS, 1972. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Aug 1972. 29p. (In Japanese). NTIS (US Sales Only).

A small size coil unit for the generation of a strong magnetic field was constructed. The magnetic field is 200,000 gauss with 4×10^4 A of current for 30 μsec, when a copper pipe of 20 mm is inserted in the center of the coil. The size was 56 ± 0.5 mm external diameter and 37 ± 0.2 mm internal diameter. A one-turn coil for a toroidal pinch was designed and manufactured. The characteristics were 20 gauss maximum field, 20 μsec magnetic field rise time, and 20,000 V insulation. A small size sprocket was made for the driving mechanism of a probe to measure the wavelength of the plasma. Manufacturing of a special small worm gear and a simple hobbing machine is reported. The worm gear is made for the driving mechanism of an $r - \theta$ probe and a Z-probe of the stellarator. Technique to make a glass vacuum pump is presented. Finishing of glass flange surface and vacuum tightness is described. (JA)

5787 (IPPV-1/1) ASPECTS OF ENERGY SUPPLY BY FUSION REACTORS. Buende, R.; Daenner, W.; Hofer, W.; Huels, M.; Poehlchen, R.; Soell, M.; Taglauer, E.; Weichselgartner, H. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Mar 1974. 57p. (In German). Dep. NTIS (US Sales Only) $6.00.

Two aspects of energy production with fusion reactors are treated, i.e., the fuel supply and the radiological impact on the environment. The specific costs for the fuels deuterium and lithium in relation to the energy released are extremely low, being only about 1/100 of the fuel cycle costs of fast breeder reactors, and so extracting lithium from sea water is an economic proposition. For this reason the energy reserves of the deuterium-tritium reactor are sufficient for 10^5 to 10^8 years, and deuterium and lithium are available to almost every country in the world. The radioactive inventory of the fusion reactor consists only of the tritium in the fuel cycle and the structure material activated in the neutron flux. The radioactivity to which the environment is subjected owing to the release of tritium can be kept below the permissible values. The activities of the structure material are solid-state activities, which are easy to handle compared with the radioactive inventory of a fission reactor. As far as the effects of emergencies are concerned, it is particularly important to note that spontaneous power excursion of the fusion reactor is impossible, and that the after-heat is at least one order of magnitude smaller than in fission reactors. From the present state of the art it is obvious that the fusion reactor affords distinct advantages over the fission reactor. (auth)

5788 (JAERI-M-5564) ANNUAL REPORT OF THE JAERI THERMONUCLEAR FUSION LABORATORY, COVERING THE PERIOD APRIL 1, 1972–MARCH 31, 1973. (Japan Atomic Energy Research Inst., Tokyo). Feb 1974. 89p. NTIS (US Sales Only).

Activities in Thermonuclear Fusion Laboratory for the period of April 1972 to March 1973 are described. During the period, the JFT-2 tokamak was brought into operation, as scheduled, and hot plasma confinement was achieved. In the JFT-1 hexapole, plasma loss processes and low-frequency fluctuations were investigated. The design of a tokamak with a teardrop-shaped cross section with an axisymmetric divertor (JFT-2a) was completed and construction of the device was started. Theoretical studies were also made of the equilibrium of a free-boundary toroidal plasma, the influence of impurity ions and surrounding neutral gases on the tokamak confinement, and thermal stability and control of a reactor "core plasma." (auth)

5789 (JAERI-M-5569) CONSIDERATION OF IGNITION AND SHUTDOWN OF THE JAERI TOKAMAK REACTOR. Ohta, M.; Tazima, T.; Yamato, H. (Japan Atomic Energy Research Inst., Tokyo). Feb 1974. 14p. NTIS (US Sales Only).

The conceptual design was completed for the 2000-MWth gas cooled reactor; the major radius is 10 m and the major radius 2 m with toroidal magnetic field 60 kG. Characteristics of the core plasma during ignition and shutdown are described numerically. It is assumed that the particle confinement time is given by pseudo-classical diffusion at lower temperatures and influenced by the anomalous diffusion of trapped-ion instability at higher temperatures. Further heating of 30 MW is required to ignite the reactor after the plasma temperature 1 keV has been attained by Joule heating. During shutdown it seems to be one of the most useful methods from the engineering point of view to stop the injection of tritium and double the injection rate of deuterium from that in steady state. (auth)

5790 (LA-5718-MS) LASER CONTROLLED THERMONUCLEAR REACTOR SYSTEM STUDIES. Williams, J. M.; Frank, T. G. (comps.). (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1974. Contract W-7405-eng-36. 30p. Dep. NTIS $4.00.

Results of initial laser-fusion central station power plant feasibility and systems studies are discussed. The functional requirements of major plant subsystems are defined and conceptual performance characteristics of subsystem components that may satisfy these requirements are described. Several conceptual reactor cavities for microexplosion containment are considered, including a wetted-wall concept, a dry wall concept, a magnetically protected concept, and a lithium vortex or BLASCON concept. A 1000-MWe laser-fusion power plant, based on CO_2 laser technology and the wetted-wall reactor cavity design, is described. Preliminary assessments of laser-fusion technology requirements are made and critical technologies that require development are identified. The results of initial laser-fusion power plant parametric and tradeoff studies which use power cost as the primary figure of merit are presented. (auth)

5791 (LA-5748-MS) MAGNETIC ENERGY TRANSFER AND STORAGE (METS) PROGRAM SCHEDULES FOR A FUSION TEST REACTOR (FTR). Rogers, J. D.; Swannack, C. E.; Thomassen, K. I.; Weldon, D. M. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1974. Contract W-7405-eng-36. 31p. Dep. NTIS $4.00.

A plan with schedules for the magnetic energy transfer and storage (METS) program for a fusion test reactor (FTR) is presented for component and materials development. The plan extends into FY's 78 and 79 and leads to the design, fabrication and operation of an applied helical-field half wavelength section of a coupled superconducting prototype system to demonstrate engineering feasibility. Facilities, components, materials, costs, and manpower are discussed in relation to the program plan and schedules. (auth)

5792 (MATT-1050) FUSION POWER PLANT. Mills, R. G. (ed.). (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Aug 1974. Contract AT(11-1)-3073. 585p. Dep. NTIS $32.25.

The book is divided into four parts: overview, technical features, system features, and remaining problems. The overview is intended for those who wish a summary of the work, but who do not wish to spare the time to read the entire document. It contains three chapters: introduction, summary of technical features, and advantages of fusion power. Chapter 2 is a brief summary and condensation of the twelve chapters of Part II, while Chapter 3 does the same for the five chapters of Part III. Part IV describes possible uses for this report and areas of future research for which needs have been discovered. The model herein described, rather than being a science fiction reporter's view of what a future power plant might be, is supposed to be a reference design to be used as a standard against which the value of different ideas and the effect of future developments may be measured. A careful effort has been made in the index to facilitate the book's use as a reference. (auth)

5793 (SAND-74-0160) PRELIMINARY SYSTEMS CONSIDERATIONS FOR AN ELECTRON-BEAM-INDUCED FUSION POWER PLANT. Varnado, S. G.; Dugan, V. L.; Klett, R. D.; Richards, R. H.; Vandevender, S. G. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1974. Contract AT(29-1)-789. 46p. Dep. NTIS $4.00.

A brief overview of systems considerations for a relativistic-electron-beam-initiated fusion power plant is presented. A conceptual configuration for the plant is described. Subsystem efficiencies are estimated and used in computing required pulse repetition rates, fuel requirements, and overall system efficiency. The effect of a hybrid (fusion-fission) blanket on overall system performance is assessed. A comparison between laser fusion reactors and E-beam fusion reactors is presented using circulating power fraction as a figure-of-merit. Suggestions for future work are given. (auth)

5794 (UCID-15990) GATING AND GAIN STABILITY OF ASTRON 6199 PHOTOMULTIPLIER SYSTEMS. Condit, W. C. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Feb 1972. 10p. Dep. NTIS $4.00.

Tests of the gating ratio, gating response time, and gain stability of the standard Astron photomultiplier-scintillator combinations were made. The gain was stable to ±8% over periods of several days. The gating ratio (on/off) was about 10^6. The gating response time was about 40 nanoseconds. (auth)

5795 (UCID-16129) LIVERMORE CTR PROGRAM, JULY 1971–SEPTEMBER 1972. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Sep 1972. Contract W-7405-eng-48. 37p. Dep. NTIS $5.00.

First results are given after roughly a year of operation of four facilities, i.e., Baseball II, 2XII, Astron with multiple pulsing, and the superconducting Levitron (SCL). Results to date are summarized. Highlights of the results, as well as those of theory and development programs, are presented. The confinement experiments and other selected topics are discussed. (auth)

5796 (UCID-16196) NEAR VACUUM TRANSPORT OF A MULTI-KILOAMPERE BEAM. Weiss, P. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 24 Jan 1973. Contract W-7405-eng-48. 17p. Dep. NTIS $4.00.

In order to investigate the feasibility of Astron-like transport of a multi-kiloampere beam, some experiments with the W-Division Pulsrad 422 Field Emission Electron machine were made. A 600-Gauss, 2-m-long solenoid passed 15 kA, which was essentially 80% of the current entering the solenoid, into a 3⅜-in. diam Faraday cup. An attempt at an emittance measurement of the incoming beam yielded an inherent spread of the order of 100 π mrad cm. (auth)

5797 (UCID-16200) CORNELLIAN ASTRON CALCULATIONS. Fessenden, T. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Jan 1973. Contract W-7405-eng-48. 25p. Dep. NTIS $4.25.

Five separate Astron topics are considered: (1) an approximate calculation of the radial field index; (2) scalloping of a long thin layer; (3) equilibria of a long thin layer; (4) adiabatic invariant for particle motion in a strong layer; and (5) axial pressure balance in a long layer. (auth)

5798 (UCRL-51617) CONCEPTUAL DESIGN OF A MIRROR REACTOR FOR A FUSION ENGINEERING RESEARCH FACILITY (FERF). Batzer, T. H.; Burleigh, R. C.; Carlson, G. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Aug 1974. Contract W-7405-eng-48. 162p. Dep. NTIS $7.60.

A small non-power-producing mirror reactor was designed for testing and evaluating the materials and components which will be used in early fusion reactors. This small fusion reactor must produce a maximum useful 14-MeV neutron flux in a volume which is large enough to accommodate many engineering-scale test specimens, yet small enough to have reasonable cost. The required technology must be close to present practice, and the required extrapolation of plasma physics beyond present experimental knowledge must be minimal. The fusion engineering research facility (FERF) described in this report produces about 1.1×10^{14} neutrons $\cdot$ cm^{-2} $\cdot$ s^{-1} at the edge of the plasma for the "low-field" coil (with Nb-Ti superconductor) although about 3.4×10^{14} neutrons $\cdot$ cm^{-2} $\cdot$ s^{-1} would be possible in a "high-field" version (with Nb_3Sn superconductor). The plasma radius is 25 cm at the center. With 13 MW of injected neutral beam, a fusion power of 3.4 MW is produced. The facility is capable of injecting 37 MW of beam in case end losses are greater than predicted. A tritium processing and containment system for the facility has been designed. (auth)

5799 POWER BALANCE IMPLICATIONS IN FUSION REACTORS. Steiner, D. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 1(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5800 HELIUM-COOLED D-T TOKAMAK POWER PLANT: UWMAK-II. Kulcinski, G. L.; Conn, R. W. (Univ. of Wisconsin, Madison). Trans. Amer. Nucl. Soc.; 19: 2(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5801 DESIGN CONSIDERATIONS FOR POWER-PRODUCING TOKAMAK-DEVICES WITH NONCIRCULAR PLASMA CROSS SECTIONS. Baker, C. C. (Georgia Inst. of Tech., Atlanta). Trans. Amer. Nucl. Soc.; 19: 2-3(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5802 PHYSICS AND ENGINEERING DESIGN CONSIDERATIONS FOR MIRROR FUSION REACTORS AND DEVICES. Moir, R. W. (Univ. of California, Livermore). Trans. Amer. Nucl. Soc.; 19: 3-4(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5803 MODULARIZED MIRROR FUSION REACTOR CONCEPT WITH EMPHASIS ON FABRICABILITY, ASSEMBLY, AND DISASSEMBLY. Peterson, M.; Werner, R. W.; Hoffman, M. A. (Univ. of California, Livermore). Trans. Amer. Nucl. Soc.; 19: 4-5(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5804 PROSPECTS FOR CONVERTING ^{232}Th TO ^{233}U IN A LINEAR THETA PINCH. Thomassen, K. I.; Krakowski, R. A.; Oliphant, T. A.; Bosler, G. E.; Dudziak, D. J. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 6(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5805 ADVANCED CONCEPTS IN FUSION–FISSION HYBRID REACTORS. Maniscalco, J. A.; Wood, L. L. (Univ. of California, Livermore). Trans. Amer. Nucl. Soc.; 19: 6–7(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5806 PROBLEMS OF DIVERTORS. Tenney, F. H. (Princeton Univ., NJ). Trans. Amer. Nucl. Soc.; 19: 7(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5807 INJECTION TECHNOLOGY FOR CONTROLLED FUSION AT LAWRENCE LIVERMORE LABORATORY. Hamilton, G. W. (Univ. of California, Livermore). Trans. Amer. Nucl. Soc.; 19: 7-8(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5808 FUSION REACTOR FIRST-WALL COOLING FOR VERY HIGH ENERGY FLUXES. Hoffman, M. A.; Werner, R. W.; Roose, T. R.; Carlson, G. A. (Univ. of California, Livermore). Trans. Amer. Nucl. Soc.; 19: 8-9(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5809 FIRST-WALL BUMPER CONCEPTS. Coultas, T. A. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 9 (1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5810 CONTROLLABILITY OF A STEADY-STATE TOKAMAK FUSION REACTOR. Sabri, Z. A. (Iowa State Univ., Ames); Husseiny, A. A. Trans. Amer. Nucl. Soc.; 19: 12-13(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5811 EVALUATION OF A CYCLOTRON RADIATION USING MONOENERGETIC ELECTRON GROUP. Chu, T. C.; Miley, G. H. (Univ. of Illinois, Urbana). Trans. Amer. Nucl. Soc.; 19: 13-14 (1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5812 FUSION BLANKETS WITH MINIMUM ACTIVATION AND MINIMUM VULNERABILITY TO RADIATION DAMAGE. Powell, J.; Lazareth, O. (Brookhaven National Lab., Upton, NY). Trans. Amer. Nucl. Soc.; 19: 17-18(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5813 FUSION-POWERED CLOSED-CYCLE GAS TURBINE POWER GENERATING SYSTEM. Biancardi, F. R. (United Aircraft Research Labs., East Hartford, CT); Meader, M. D.; Powell, J. R. Trans. Amer. Nucl. Soc.; 19: 18-19(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5814 REMOVAL OF TRITIUM FROM SOLID CTR BLANKET MATERIAL. Wiswall, R. H. Jr.; Wirsing, E. (Brookhaven National Lab., Upton, NY). Trans. Amer. Nucl. Soc.; 19: 20(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5815 HYDROGEN ISOTOPE DISTILLATION IN A FUSION REACTOR SYSTEM. Wilkes, W. R. (Monsanto Research Corp., Miamisburg, OH). Trans. Amer. Nucl. Soc.; 19: 20(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5816 STUDY OF NONMOBILE BLANKETS WITH LOW LITHIUM INVENTORIES. Abdou, M. A.; Maynard, C. W. (Univ. of Wisconsin, Madison). Trans. Amer. Nucl. Soc.; 19: 20-22 (1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5817 MATERIALS FOR NONMOBILE BLANKETS. Wittenberg, L. J. (Univ. of Wisconsin, Madison). Trans. Amer. Nucl. Soc.; 19: 22-23(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5818 RECOIL ENERGY DISTRIBUTIONS IN CTR-RELATED NEUTRON SPECTRA. Parkin, D. M. (Los Alamos Scientific Lab., NM); Goland, A. N. Trans. Amer. Nucl. Soc.; 19: 23-24 (1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5819 NEUTRONICS FOR BLANKET AND SHIELD DESIGN IN FUSION REACTOR STUDIES. Conn, R. W.; Abdou, M. A.; Maynard, C. W. (Univ. of Wisconsin, Madison). Trans. Amer. Nucl. Soc.; 19: 457(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5820 REVIEW OF CTR NUCLEAR DATA REQUIREMENTS. Steiner, D. (Oak Ridge National Lab., TN); Dudey, N. D.; Leonard, B. R. Jr.; McNally, J. R. Jr.; Price, L. K. Trans. Amer. Nucl. Soc.; 19: 457-459(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5821 D–T FUSION REACTOR ACTIVATION AND AFTER-HEAT. Price, W. G. (Princeton Univ., NJ); Dudziak, D. J.; Lee,

J. D.; Powell, J. R.; Steiner, D.; Vogelsang, W. F. Trans. Amer. Nucl. Soc.; 19: 459(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5822 SHIELD DESIGN FOR A THETA-PINCH FUSION ENGINEERING RESEARCH FACILITY (FERF). Gerstl, S. A. W. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 459-461(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5823 SHIELD DESIGN FOR A MIRROR FUSION RESEARCH FACILITY (FERF). Wilcox, T. P. (Univ. of California, Livermore). Trans. Amer. Nucl. Soc.; 19: 461-462(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5824 SHIELDING DESIGN CALCULATIONS FOR ORMAK-F/BX. Gabriel, T. A.; Santoro, R. T.; Engle, W. W. Jr. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 462 (1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5825 COMPARISON OF CROSS-SECTION SENSITIVITIES OF BREEDING RATIOS IN FUSION-REACTOR BLANKETS. Alsmiller, R. G. Jr.; Barish, J.; Gabriel, T. A.; Santoto, R. T. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 463-464 (1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5826 LASER-FUSION-REACTOR-INDUCED RADIOACTIVITY AND AFTERHEAT. Frank, T. G.; Duziak, J. D.; Heck, E. L. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 464(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5827 SENSITIVITY OF RTPR AFTERHEAT AND RADIOACTIVITY TO ^{94}Nb CROSS-SECTION UNCERTAINTY. Muir, D. W.; Dudziak, D. J. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 465(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5828 NEUTRON FLUX DISTRIBUTION CALCULATIONS FOR THE LAMPF RADIATION EFFECTS FACILITY. Dudziak, D. J.; Simmons, M. L.; Russell, G. J. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 465-467(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5829 APPLICATIONS OF DISCRETE-ENERGY S_n TRANSPORT CALCULATIONS TO THE NEUTRONICS OF CTR BLANKETS AND SHIELDS. Ostrow, S.; Goldstein, H. (Columbia Univ., NY). Trans. Amer. Nucl. Soc.; 19: 467-468(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5830 BONDARENKO FORMALISM APPLIED TO THETA-PINCH REACTOR NUCLEONICS. Soran, P. D.; Dudziak, D. J. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 468-469(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5831 CONSISTENT MODEL FOR ENERGY DISTRIBUTION OF SECONDARY NEUTRONS FROM (n, 2n) AND (n, n^1) REACTIONS. Sawan, M.; Conn, R. (Univ. of Wisconsin, Madison). Trans. Amer. Nucl. Soc.; 19: 469-470(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5832 PROCEDURE AND APPARATUS FOR CONTAINING A HIGH-TEMPERATURE PLASMA. Bass, R. W.; Ferguson, H. R. P.; Fletcher, H. J.; Gardner, J. H.; Harrison, B. K.; Larsen, K. M. Danish Patent 5653,73. 4 Jun 1974. 43p. (In Danish).
The invention is concerned with a method for generating energy by fusion. This requires to contain the plasma for a sufficiently long time for fusion processes to take place and, therefore, a particular magnetic field configuration which is described. This maintains the plasma in a toroidal configuration without spikes and with a non-convex polar cross section, where the magnetic lines of force are tangent to the surface of the plasma. (DE)

5833 FUSION REACTORS AS FUTURE ENERGY SOURCES. Post, R. F.; Ribe, F. L. (Univ. of California, Livermore). Science; 186: No. 4162, 397-407(1 Nov 1974).
The use of fusion energy in planning for the world's future energy needs is discussed. The potential of fusion energy and the problems that remain to be solved before it is realized are described along with the physical conditions required for the fusion process. Various fuel cycles are outlined and some magnetic and inertial confinement approaches to controlled fusion are discussed. These include magnetic mirror, tokamak, and theta pinch concepts. Reactor systems for these concepts are briefly described. Some of the environmental characteristics of fusion reactors are also mentioned. (MOW)

5834 E-LAYER TRAPPING IN ASTRON BY RESISTOR INTERACTION: THEORY AND EXPERIMENT. Stallard, B. W.; Fessenden, T. J. (Lawrence Livermore Lab., CA). Phys. Fluids; 17: No. 3, 575-581(Mar 1974).
The interaction of a moving E layer with the resistor structures that line the walls of the Livermore astron apparatus is studied theoretically and experimentally. It is shown that for a weak interaction no change in mean layer radius results from the energy loss in the resistors. Using the approximation of a long thin layer in axisymmetric geometry, curves are given for calculating the energy dissipated in the resistors per meter traveled or, equivalently, the axial force on the moving layer. Results of experiments are reported showing transport of the incoming layer in the astron tank and trapping in the magnetic mirrors. Measurements of the damping of E-layer axial motion in several resistor geometries show typical damping times of 0.5 μsec. Comparison of experiment and theory shows agreement within about a factor of 2. (auth)

5835 ROTATIONAL STABILIZATION OF A METALLIC LINER. Book, D. L.; Winsor, N. K. (Naval Research Lab., Washington, DC). Phys. Fluids; 17: No. 3, 662-663(Mar 1974).
Taylor instability of the imploded metallic liner used in axial flux compression experiments can be stabilized by linear rotation. One can either remove the instability or limit its amplitude by choosing the rotation speed. The cost (in field compression efficiency) of stabilization is calculated. (auth)

Wave Phenomena

5836 (AD-778517) NONLINEAR TRANSFORMATION OF EMISSION INTO PLASMA WAVES. Pustavalov, V. V.; Silin, V. P.; Tikhonchuk, V. T. (AN SSSR, Moscow. Fizicheskij Inst.). 17 Apr 1974. Translation by J. E. Pearson of Preprint 104. 30p. NTIS $3.25.
As a result of analysis and the solution of a nonlinear integral equation, the steady-state spectral distribution and the electric field intensity of high-frequency plasma waves (plasmons), parametrically stimulated by a powerful nonpotential pumping wave in a homogeneous isotopic plasma at a pumping field frequency close to double that of the langmuir electron frequency were found. The induced scattering of plasma waves by ions and the nonlinear shift in plasma wave frequency are the nonlinear mechanisms for noise level saturation, which lead to a primarily parametrically unstable plasma to a steady-state turbulent state. The coefficient of nonlinear transformation of pumping emission energy into plasma waves attains magnitudes of the order of unity at slight exceedings of the threshold value pumping fluxes. (auth)

5837 (AEC-tr-7586) DYNAMICS OF FORMATION AND INTERACTION OF LANGMUIRIAN SOLITONS AND STRONG TURBULENCE. Degtyarev, L. M.; Makharkov, V. G.; Rudakov, L. I. (AN SSSR, Moscow. Inst. Prikladnoj Matematiki). Oct 1974. Translation by W. J. Grimes of Preprint No. 18. 27p. Dep. NTIS $4.50.
A study of a model of a strong Langmuirian turbulence as a "gas" of Langmuirian solitons, e.g., lumps of oscillations, located in regions of reduced plasma density, arising under the influence of the pressure from a hf field is presented. Using a computer in the one-dimensional case, the article describes the study of the formation of solitons from broad packets of Langmuirian waves and elementary processes involving the solitons—merger of solitons in pair collisions, interaction of a soliton with sound pulses, breakup of a soliton by sound, created in the merger of two solitons. A kinetic equation is developed for a gas composed of solitons. Its solution is found to be in satisfactory agreement with the results of numerical modeling of one-dimensional Langmuirian turbulence. (auth)

5838 (ANU-PF-10) EQUILIBRIUM CONDITIONS BEHIND SHOCK WAVES INTO A MONATOMIC GAS. Meier, P. (Austra-

lian National Univ., Canberra). Nov 1972. 65p. Dep. NTIS (US Sales Only) $6.25.

A numerical method for solving the Saha equations for several ionization stages together with the equations of conservation of mass, momentum and energy across a normal, refracted and reflected shock into a monatomic gas is presented. The interactions between the particles are considered within the Debye theory. As an example, calculations were done with argon, considering ArI to ArV. The results for normal shocks into argon at initial pressures between 0.1 to 100 mmHg were plotted in the range T = 10,000 to 60,000°K and $N_e = 10^{15}-10^{19}$ cm^{-3}. The set of programs discussed here, can also be used to obtain contours of any property of such a plasma, as for example to get a Mollier diagram. (auth)

5839 (CKRL-TN-F-36) REFRACTION OF ONE-DIMENSIONAL MHD SHOCK. Bestman, A. R. (Sydney Univ. (Australia). Dept. of Mechanical Engineering). May 1972. 19p. Dep. NTIS (US Sales Only) $4.00.

The refraction of a one-dimensional MHD shock at an interface between two different perfectly conducting, inviscid gases is discussed. The main objective is to obtain a realistic definition of shock impedance for head-on wave incidence. The definition obtained is consistent with the magneto-acoustic limit, and with the familiar Polachek & Seeger result in the limit of vanishing magnetic field. (auth)

5840 (CKRL-TN-F-43) DIFFRACTION OF HYDROMAGNETIC SHOCKS. Bestman, A. R. (Sydney Univ. (Australia). Dept. of Mechanical Engineering). [nd]. 27p. Dep. NTIS (US Sales Only) $4.50.

The diffraction of a plane hydromagnetic shock, propagating perpendicularly to the magnetic field, by a wedge-like wall of small angle ϵ is discussed. It is observed that the solution is multi-valued. An appeal to the physics of the problem was found necessary to select a unique solution. (auth)

5841 (CKRL-TN-F-44) MAGNETOGASDYNAMIC SHOCK POLARS FOR PERPENDICULAR SHOCK AND SHOCKS IN ALIGNED FIELD. Bestman, A. R. (Sydney Univ. (Australia). Dept. of Mechanical Engineering). [nd]. 28p. Dep. NTIS (US Sales Only) $4.50.

The magnetogasdynamic shock polar is developed in the total pressure, P*, flow deflection, δ, – (δ, P*)-plane. It is hoped that this representation will be more useful in the study of wave interactions, especially three-wave confluences and wave interaction at a gas interface, for these classes of shocks. (auth)

5842 (CKRL-TN-F-45) CONFLUENCES OF THREE SHOCK WAVES FOR PERPENDICULAR SHOCKS AND SHOCKS IN ALIGNED MHD FIELD. Bestman, A. R. (Sydney Univ. (Australia). Dept. of Mechanical Engineering). Oct 1972. 17p. Dep. NTIS (US Sales Only) $4.00.

The confluence of three shock waves meeting at a point, in an ideally conducting perfect gas, for perpendicular shocks and shocks in aligned MHD field, is studied. The problem is discussed by using the powerful hodograph mapping technique. The complexity of the problem prohibits the discussion of an alternate mathematical approach. (auth)

5843 (CKRL-TN-F-50) REFRACTION OF HYDROMAGNETIC SHOCKS. Part I. Perpendicular Shocks. Bestman, A. R. (Sydney Univ. (Australia). Dept. of Mechanical Engineering). [nd]. 31p. Dep. NTIS (US Sales Only) $4.75.

The refraction of a plane perpendicular shock wave at an interface between two streams of different magnetic Mach numbers is discussed. Both regular and irregular refractions are considered by using the hodograph mapping technique. For regular refraction, the solution is observed to be multi-valued and a discussion of the various boundary conditions is found necessary and sufficient to obtain a unique solution for the reflected wave, which is always either a shock or an expansion fan. For irregular systems, it is found that when the interface is slow-fast, that is when the total sound speed a_{01}^* in the incident medium is less than the total sound speed a_{02}^* in the transmitted medium, then there are two irregular systems, one being a double-Mach reflection type while the other is a four-wave confluence type. There are also two irregular systems when the refraction is fast-slow; these are single-Mach reflection type and an expansion wave type. (auth)

5844 (IPP-IV-73) TOTALITY OF WAVES IN A HOMOGENEOUS VLASOV PLASMA. Puri, S.; Tutter, M. (Max-Planck-Institut fuer Plasmaphysik, Garching/Muenchen (F. R. Germany)). Aug 1974. 27p. Dep. NTIS (US Sales Only) $4.50.

It is shown that the total number N, of wave pairs for a given frequency ω in a nonrelativistic, magnetized, homogeneous Vlasov plasma is countably infinite and is given by N = 3n + 2, where n is the number of cyclotron harmonics. For reason of simplicity, the counting is performed for waves propagating perpendicular to the static magnetic field. The branches of the extraordinary and the ordinary modes lying immediately below the cyclotron harmonic frequencies found by Dnestrovskij and Kostomarov are identified respectively as "magnetostatic" and "zero field" waves in the limit of large propagation constant. (auth)

5845 NONLINEAR PHENOMENA IN PLASMA. Kadomtsev, B. Veda Tech. SSSR; 1: No. 3, 41-45(Jun 1973). (In Czech).

Translated from Russian.

A brief description of four cases of nonlinear phenomena in plasma is presented, namely the Landau damping, the echo, the induced scattering of waves, the ion sound turbulence. (auth)

5846 NONLINEAR LANDAU DAMPING IN A RADIALLY INHOMOGENEOUS CYLINDRICAL PLASMA. Hewett, D. W.; Armstrong, T. P. (Univ. of Kansas, Lawrence). Phys. Fluids; 17: No. 3, 595-599(Mar 1974).

The nonlinear Vlasov equation is solved numerically as an initial value problem for an electrostatically confined cylindrical plasma with a Gaussian density profile. Electrostatic perturbations are excited by imposing a small sinusoidal density variation in the axial direction. The resulting oscillations of the axial and radial components of the electric field are studied to determine approximate frequencies and damping decrements from the first few oscillations. As the width of the Gaussian profile is decreased, making the plasma more inhomogeneous, the oscillation frequencies decrease and the damping decrements increase. Nonlinear distortions of the distribution function in the neighborhood of $v_z = v_{ph}$ are observed. (auth)

5847 LINEAR SIDEBANDS. Morales, G. J.; Malmberg, J. H. (Univ. of California, San Diego, La Jolla). Phys. Fluids; 17: No. 3, 609-620(Mar 1974).

The existence of a new mechanism by which waves at nearby frequencies can be excited when a small amplitude, monochromatic, electron plasma wave is launched in a collisionless plasma is reported. The amplitude of these excited sidebands depends linearly on the amplitude of the launched wave, hence they have been named linear sidebands. A striking feature of linear sidebands is that their amplitude exhibits large spatial oscillations, while the amplitude of the wave exciting them damps monotonically according to the linear theory of Landau. Linear sidebands arise from the interaction of the launched wave with pre-existing low-frequency, streaming perturbations in the electron distribution function having the functional form: $g(\omega,v)\exp[i\omega(t - x/v)]$. The existence of a continuous spectrum of streaming perturbations in a collisionless plasma has been established by identifying the excited plasma wave echoes that appear when a heavily damped wave is launched. A generalization of the echo theory predicts the existence of linear sidebands and is in good quantitative agreement with the experimental observations of the linear sideband properties. It is experimentally observed that the well-known trapped-particle sidebands can evolve continuously from the linear sidebands as the amplitude of the launched wave is increased. (auth)

ENGINEERING

Energy Conversion

5848 (JUL-1072-TP) CONSTRUCTION OF A THERMIONIC DIODE WITH HEAT TUBE COLLECTOR. Erley, W.; Lehwald, S. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Technische Physik). May 1974. 40p. (In German). Dep. NTIS (US Sales Only) $5.25.

The construction of a thermionic diode and its component parts (emitter, collector, diode housing, and cesium reservoir) and the electrical measurement circuit for determining the current-voltage characteristic lines are described in detail. The testing of the collector-heat tube unit and of the complete diode is described. The collector failed after 126 hrs of operation. Metallographic and x-ray studies made to determine the reasons for the porosity indicated welding errors. All other components functioned without failure. (JSR)

5849 DEVICE FOR CONVERTING NUCLEAR ENERGY INTO ELECTRICAL ENERGY. Greatbatch, W. (to Wilson Greatbatch Ltd.). US Patent 3,836,798. 17 Sep 1974. Filed Date 15 Aug 1972. 6p.

A device for converting nuclear energy into electrical energy comprising a radioactive nuclide, preferably a core of lithium enveloped by a coating of lithium hydride, an energy converting material enveloping the nuclide, and a pair of terminals connected in the converting material is described. The converting material preferably comprises silicon having diffused therein impurities of p-type and n-type material thereby defining opposite conductivity regions separated by a junction. The terminals are connected to corresponding ones of the regions, and electron-hole pairs are created in the regions upon bombardment by beta particles from the nuclide thereby creating a flow of current across the junction and an electrical potential across the terminals. The device advantageously can be utilized in conjunction with an artificial cardiac pacemaker whereby the stimulating pacemaker output pulses are generated at a non-linear rate. (Official Gazette)

Facilities and Equipment

Refer also to abstracts 5918, 7109, and 7507.

5850 (ORNL-4979, pp 68-69) X-RAY EXPOSURE FACILITY. Stansbury, P. S.; Poston, J. W. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The design criteria for the facility include suitable shielding for a 125-kVcp x-ray machine, space to perform experiments under conditions of good geometry, and provision for other incidental facilities. (MCG)

5851 (ORNL-TM-4646) CURT-II: A COMPUTER PROGRAM FOR ANALYZING CURVED TUBES OR ELBOWS AND ATTACHED PIPES WITH SYMMETRIC AND UNSYMMETRIC LOADINGS. Gwaltney, R. C. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 66p. AT.

CURT-II is a computer code that calculates stresses and displacements in a shell structure made up of curved or straight cylindrical segments such as those in a piping system. Loadings considered are internal pressure and/or arbitrary end loadings that may be distributed symmetrically or nonsymmetrically around the circumference. This report is primarily an instruction manual for using CURT-II. Input and output are described in detail, and a Fortran listing of the code is included. Sample problems that show comparisons between experimental and the analytical results are also included. (auth)

5852 STRESSES IN CYLINDRICAL AND SPHERICAL WALLS SUBJECTED TO INTERNAL PRESSURE AND STATIONARY HEAT FLOW. Vollbrecht, H. Verfahrenstechnik; 8: No. 4, 109-112(Apr 1974). (In German).

7 figs.; 7 refs.

Heat flow and internal pressure both give rise to a three-dimensional stress system in thick-walled vessels. The stresses can be analyzed with the aid of thick cylinder and hollow sphere (shear stress) theories. The figures thus obtained are added algebraically to the tangential thermal stresses. This does not represent actual conditions, if the thermal stresses are not higher than the compressive stresses of the same sign and if they disappear on adding the compressive and thermal stresses of opposite sign. Values obtained by the calculation method currently described in AD-Merkblatt B10 are on the high side, but this gives a factor of safety. (auth)

5853 FOUNDATIONS OF FRACTURE MECHANICS TECHNOLOGY. Paris, P. C. (Brown Univ., Providence). Trans. Amer. Nucl. Soc.; 19: 119(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5854 PHILOSOPHY AND GENERAL ENGINEERING APPROACHES FOR APPLYING FRACTURE MECHANICS TECHNOLOGY. Wessel, E. T. (Westinghouse Research Labs., Pittsburgh). Trans. Amer. Nucl. Soc.; 19: 119(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5855 METHODS AND EXAMPLES FOR SOLVING REALISTIC PROBLEMS. Clark, W. G. Jr. (Westinghouse Research Labs., Pittsburgh). Trans. Amer. Nucl. Soc.; 19: 121(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5856 SPECIFIC EXAMPLES WHERE TECHNOLOGY HAS BEEN APPLIED IN THE NUCLEAR INDUSTRY. Corten, H. T. (Univ. of Illinois, Urbana). Trans. Amer. Nucl. Soc.; 19: 121 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Lasers

Refer also to abstracts 5769, 5979, and 7147.

5857 (AD-779917) OPTICS RESEARCH: 1973:2. Semiannual Report, 1 July-31 December 1973. Rediker, R. H. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 31 Dec 1973. Contract F19628-73-C-0002. 75p. (ESD-TR-74-17). NTIS $3.75.

The report covers work of the Optics Division at Lincoln Laboratory for the period July 1 through December 31, 1973. The topics covered are laser technology and propagation and optical measurements and instrumentation. (auth)

5858 (JPRS-63317) GAS DYNAMIC LASER WITH ELECTRIC EXCITATION OF A THERMALLY IONIZED GAS. Biryukov, A. S.; Marchenko, V. M.; Shelepin, L. A. Translated from Dokl. Akad. Nauk SSSR; 217: No. 3, 540-543(1974). 6p. NTIS.

The possibility of increasing the inversion in a gas dynamic CO_2 laser by exciting the molecules by electron collision in a discharge is considered. (auth)

5859 (UCID-16120) EFFECTS OF INTENSE CO_2 RADIATION ON PULSED HF CHEMICAL LASER SYSTEMS. Turner, C. E. Jr.; Pan, Y. L.; Blasberg, D. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 May 1972. Contract W-7405-eng-48. 24p. Dep. NTIS $4.25.

In certain pulsed chemical laser systems, for example, those in which vibrationally excited HF is produced, it appears that chain branching reactions uniformly initiated over large volumes will be required to overcome the detrimental effects of vibrational relaxation and three-body recombination in order to obtain high power and high energy density at attractive efficiency. However, a conflict is imposed by pulsed operation, namely, the necessity to premix the reactive gases under conditions of pressure and temperature for which the mix is stable until initiation. With the above requirements in mind, we have assembled a pin-discharge chemical laser in which the reactive gases can be rapidly preheated by a pulse of 10.6μ radiation (up to 90 J in $\lesssim$2 μs) from a double-discharge TEA CO_2 laser. The objective, conceptually, is to hold off the main radical-producing initiation pulse until the pressure-temperature coordinates of the premixed gases have shifted from a stable region into a region of branched chain reaction contributing to laser action. The preheat mechanism used is rapid V-T transfer from a vibrationally excited reactant, such as N_2F_4, or diluent, e.g., SF_6. With this versatile system we have been able to: (1) search for chemical laser action initiated purely by CO_2 laser radiation, (2) search for evidence of branched chain reaction, namely, very rapid development of chemiluminescence upon laser irradiation or enhancement of the chemical laser power output in the preheated discharge, and (3) study implicitly the temperature dependence of some chamical laser systems. Initial investigations have been performed on various mixtures of (NF_3, H_2, SF_6) and (N_2F_4, H_2). Under conditions studied so far no chemical laser

oscillation has been observed in explosions initiated by the CO_2 laser alone. In some preheated cases there appears to be enhancement of the HF laser power in the first of the cascading-transition output peaks but no real indication of branched chain reaction has yet been found. (auth)

5860 (UCID-16232) DYE CELL TRANSMITTANCE RECORDING PHOTOMETER. Pierce, E. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Mar 1973. Contract W-7405-eng-48. 12p. Dep. NTIS $4.00.

A small, compact, and inexpensive photometer is used to continually measure the transmittance of a dye solution in a mode-locked oscillator without removal of solution from the system. (auth)

5861 (UCRL-74813) DAMAGE CONSTRAINTS IN THE DESIGN OF HIGH ENERGY LASERS FOR FUSION APPLICATIONS. Glass, A. J.; Guenther, A. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Sep 1973. 19p. (CONF-730836-4). Dep. NTIS $4.00.

From 3rd workshop on laser interaction and related plasma phenomena; Troy, New York, USA (13 Aug 1973).

The design of large glass lasers for fusion applications is strongly influenced by considerations of the laser induced damage of optical materials. The laser requirements are reviewed. Damage phenomena in laser glass, thin film coatings, and other optical elements are discussed. The feedback problems arising from target reflection are considered. The principal causes of laser damage include self-focusing in the laser glass, damage at dielectric surfaces, and thin film damage. The theory and phenomenology of these processes is discussed. Possible future developments which will reduce or circumvent damage problems are proposed. (auth)

5862 (Y-1951) MINICOMPUTER CONTROL SYSTEM FOR AN ULTRAPRECISION TURNING MACHINE. Burleson, R. R. (Oak Ridge Y-12 Plant, Tenn. (USA)). 11 Nov 1974. Contract W-7405-eng-26. 51p. Dep. NTIS $5.45.

An ultraprecision machining capability is needed to meet the requirements for aspherical, optical-quality surfaces for the laser-fusion program. A minicomputer-based control system was developed for use on a Moore Number 3 measuring machine which was transformed into a very accurate contouring machine tool. A 15-inch-diameter by 2-inch-thick copper-plated aluminum disc was machined to a 600-inch-radius spherical contour to determine the viability of the system. The surface finish was 50 nm, peak to valley, with a contour error of less than 2500 nm. (auth)

5863 ENHANCEMENT OF He–Ne LASERS BY NUCLEAR RADIATION. De Young, R. J.; Wells, W. E.; Miley, G. H. (Univ. of Illinois, Urbana). Trans. Amer. Nucl. Soc.; 19: 66(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5864 MEASUREMENT OF OPTICAL GAIN VIBRATIONAL TRANSITIONS OF CO GAS EXCITED ONLY BY FISSION FRAGMENTS. McArthur, D. A.; Tollefsrud, P. B. (Sandia Labs., Albuquerque, NM). Trans. Amer. Nucl. Soc.; 19: 356(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5865 INFLUENCE OF DISCHARGE CURRENT STABILIZATION ON STABILITY OF He–Cd^+ LASER POWER OUTPUT. Chlojnacki, J.; Mizeraczyk, J. (Instytut Maszyn Przeplywowych PAN, Gdansk, Poland). Elektronika; 15: No. 6, 259-260(1974). (In Polish).

A circuit diagram of a high-voltage power supply, with stabilization of output current for ion metal-vapor laser discharge tubes is described. It was proved experimentally that the use of such a power supply unit decreases the low frequency power output fluctuations of He–Cd^+ laser. (auth)

5866 HF LASER INITIATED BY A 300-keV ELECTRON BEAM. Patterson, E. L. (Sandia Labs., Albuquerque, NM); Gerber, R. A.; Blair, L. S. J. Appl. Phys.; 45: No. 4, 1822-1825(Apr 1974).

An intense electron beam was used to initiate HF lasing in mixtures of SF_6 and C_2H_6. Parametric studies of this highly superradiant chemical-laser system were performed to determine optimum composition of the SF_6/C_2H_6 mixture. The maximum laser energy measured was 5.5 J in a pulse width (FWHM) of 45 nsec. The efficiency for conversion of deposited electron-beam energy to laser energy was approximately 4%. The chemical reactions and the limits on the production of fluorine atoms and of vibrationally excited HF are discussed. (auth)

5867 OPERATION OF A SMALL SINGLE-MODE STABLE CW HYDROGEN FLUORIDE LASER. Hinchen, J. J. (United Aircraft Research Labs., East Hartford, CT). J. Appl. Phys.; 45: No. 4, 1818-1821(Apr 1974).

A small hydrogen fluoride mixing laser was developed which produces cw radiation with excellent short-term amplitude stability (variation less than ±1.5%) and requires only 14 liter/sec pumping capacity. Using a grating and a semitransparent mirror mounted on a piezoelectric crystal for laser cavity optics, the laser was made to operate on a single molecular transition and also on a single cavity mode. By varying the cavity length it was possible to tune the laser over about 300 MHz. The gain of the laser was established at about 30% by measurement of mode pulling and also by direct gain measurement. (auth)

5868 LASER HANDBOOK. Volume 1. Arecchi, F. T.; Schulz-Dubois, E. O. (eds.). New York; American Elsevier Publishing Company (1972). 1044p.

The main subject areas discussed in Volume I include basic theory and laser physics, classes of lasers, laser devices and techniques, and materials for nonlinear optics. Several papers are given dealing with each subject area. (MOW)

5869 LASER HANDBOOK. Volume 2. Arecchi, F. T.; Schulz-Dubois, E. O. (eds.). New York; American Elsevier Publishing Company (1972). 927p.

Volume II contains 17 papers on physical and technical applications of lasers. Some of the applications include scattering diagnosis, Raman spectroscopy, metrology, photography, information processing, and communications. (MOW)

5870 OBSERVATION OF COMPRESSED PICOSECOND PULSES OF HIGH REPETITION RATE FROM A Nd-GLASS LASER. Drexhage, K. H.; Eienthal, K. B. (IBM Research Lab., San Jose, CA). J. Appl. Phys.; 45: No. 6, 2614-2615(Jun 1974).

Picosecond pulses generated by a mode-locked neodymium-glass laser have been compressed down to 0.5 psec with a repetition rate up to 3×10^{11} Hz by the insertion of a glass flat inside the laser cavity. The reduction in pulse width is attributed to a frequency-dependent transit time on transmission through the glass flat. (auth)

5871 ELECTRON-BEAM SPREADING AND ITS EFFECT ON SUSTAINER CURRENT AND FIELD DISTRIBUTION IN CO_2 LASERS. Jacob, J. H.; Reilly, J. P.; Pugh, E. R. (Avco Everett Research Lab., MA). J. Appl. Phys.; 45: No. 6, 2609-2613(Jun 1974).

An electron-beam-initiated high-pressure CO_2 laser discharge was investigated. It is assumed that initially the discharge current flows along the vacuum electric field direction. The resulting distortion of the electric field is calculated by a linearization of the continuity equation. The solution was calculated for the special case of a finite electron beam and infinite planar electrodes. The predicted variation of the sustainer current and distortions of the applied voltage are compared with experimental results. (auth)

5872 HOLLOW-CATHODE COPPER-VAPOR LASER. Fahlen, T. S. (GTE Sylvania Inc., Mountain View, CA). J. Appl. Phys.; 45: No. 9, 4132-4133(Sep 1974).

The design and operation of a hollow-cathode copper-vapor laser are discussed. The sole source of copper atoms is the pulsed glow discharge inside the hollow cathode, which generates copper vapor by sputtering and heating of the copper-plated cathode. With no optimization of the laser parameters 270 mW of green output power were obtained at a 12-kHz pulse repetition frequency from a 1-m-long tube. (auth)

5873 ANALYSIS OF RING DISTRIBUTED-FEEDBACK LASERS. Wang, S.; Tsang, W. T. (Univ. of California, Berkeley). J. Appl. Phys.; 45: No. 9, 3978-3980(Sep 1974).

Here a structure for ring distributed feedback (DFB) lasers is proposed and analyzed. The threshold condition for such lasers is derived and compared with that for plain DFB lasers. It is shown that the etalon and feedback effects provided by the uniform section of a ring DFB laser should narrow the laser bandwidth and lower the threshold gain. (auth)

5874 ANALYSIS OF DISTRIBUTED-FEEDBACK AND DISTRIBUTED-BRAGG DEFLECTOR LASER STRUCTURES BY METHOD OF MULTIPLE REFLECTIONS. Wang, S.; Cordero, R. F.; Tseng, C. C. (Univ. of California, Berkeley). J. Appl. Phys.; 45: No. 9, 3975-3977(Sep 1974).

A new method based on multiple reflections is proposed for analyzing thin-film Bragg devices in integrated optics. Expressions are derived for reflection and transmission coefficients at the interface between a uniform and periodic waveguide. The method is used to find the response of distributed-feedback laser amplifiers and the noise output of distributed-Bragg-reflector lasers. (auth)

5875 CATASTROPHIC FAILURE IN GaAs DOUBLE-HETEROSTRUCTURE INJECTION LASERS. Hakki, B. W.; Nash,

F. R. (Bell Labs., Murray Hill, NJ). J. Appl. Phys.; 45: No. 9, 3907-3912(Sep 1974).

Catastrophic failure in GaAs double-heterostructure (DH) injection lasers is shown to manifest itself in two ways concurrently: rupture of one or both laser mirrors, and internal damage to the laser active region. When the electroluminescent emission is observed in a direction normal to the plane of the junction, internal damage takes the form of a dark line which starts from the damaged mirror and extends normal to it into the active region. The increase in lasing threshold and decrease of external efficiency of a catastrophically damaged laser are due to (1) decrease in reflectivity of the damaged mirror, (2) reduction of electronic gain (and possible conversion into loss) of the active region immediately adjacent to the dark line, and (3) optical scattering due to internal crystal damage associated with the dark line. It is shown that catastrophic damage in GaAs is consistent with a model whereby failure occurs when the optical electric field intensity at the GaAs mirror exceeds a certain critical value. In the best-quality GaAs material available, this critical optical field intensity is ≈120 kV/cm for 100-ns pulse lengths. (auth)

5876 PHOTON RECYCLING IN SEMICONDUCTOR LASERS. Stern, F.; Woodall, J. M. (IBM Watson Research Center, Yorktown Heights, NY). J. Appl. Phys.; 45: No. 9, 3904-3906(Sep 1974).

In a suitably designed semiconductor laser, spontaneously emitted photons with energies above the absorption edge can be reabsorbed in the active layer and can decrease the current density that must be supplied to reach the lasing threshold. The magnitude of the threshold reduction is estimated to be about 20% in a GaAs double-heterostructure laser at room temperature. (auth)

5877 RAPID DEGRADATION PHENOMENON IN HETERO-JUNCTION GaAlAs–GaAs LASERS. Petroff, P.; Hartman, R. L. (Bell Labs., Murray Hill, NJ). J. Appl. Phys.; 45: No. 9, 3899-3903(Sep 1974).

The rapid degradation phenomenon in $Ga_{1-x}Al_xAs$-GaAs DH lasers has been associated with the growth of a dislocation network during the device operation. The nature of these defects has been analyzed by transmission electron microscopy in an effort to understand their origin and growth mechanism. The propagation of the dislocation network is found to take place by successive climb of a dislocation crossing the n-$Ga_{1-x}Al_xAs$, p-GaAs, and p-$Ga_{1-x}Al_xAs$ layers in the stripe area. The climb process leads to the formation of a three-dimensional dislocation dipole network which extends through the three epitaxial layers and remains confined to the stripe area. A tentative model which discusses the network growth process is presented. The source of the very large vacancy concentration involved in the climb process has been attributed to the interfaces between the binary and ternary layers. The fast climb rate has been related to large drift forces acting on the vacancies during the device operation. The dominant drift forces are thought to be electrical and elastic in nature. (auth)

5878 EFFICIENCY OF COUPLING LIGHT FROM STRIPE-GEOMETRY GaAs LASERS INTO MULTIMODE OPTICAL FIBERS. Brackett, C. A. (Bell Labs., Murray Hill, NJ). J. Appl. Phys.; 45: No. 6, 2636-2637(Jun 1974).

The coupling between GaAs injection lasers and multimode optical fibers using spherical ends on the optical fibers is examined. In particular, the results previously published by Kato are shown to be overly optimistic, although considerable improvement over using a flat-ended fiber is still predicted. Neglecting reflection losses, maximum coupling efficiencies of the order of 60 to 70% are predicted for typical double-heterostructure laser diodes. (auth)

5879 GAIN-NARROWING STUDIES WITH AN ORGANIC DYE LASER. Marowsky, G. (Max-Planck-Institut fuer Biophysikalische Chemie, Goettingen, Ger.). J. Appl. Phys.; 45: No. 6, 2621-2623(Jun 1974).

Efficient spectral narrowing of the emission of a flashlamp-pumped dye laser with nonresonant feedback is reported. Line narrowing from 32 nm to less than 2 nm at peak output powers up to 15 kW was observed. (auth)

5880 ELECTRONIC COLLISION: INDUCED TRANSITION BETWEEN THE UPPER LEVELS OF A He-Cd LASER. Sakurai, T. (Twente Univ. of Tech., Enschede, Netherlands). J. Appl. Phys.; 45: No. 6, 2666-2667(Jun 1974).

Interruption of the laser field in a 4416-Å He-Cd laser modulates the spontaneous emissions originating not only from the laser levels but also from other excited levels. From the measurement of the intensity ratio of these spontaneous emissions, the rate coefficient of the transition between $4d^9\ 5s^2$ configurations in Cd II induced by electronic collision and its cross section are obtained. The total deexcitation rate of the level by electronic collision is also measured. (auth)

5881 EXTRINSIC ABSORPTION IN 10.6-μm-LASER-WINDOW MATERIALS DUE TO MOLECULAR-ION IMPURITIES. Duthler, C. J. (Xonics, Inc., Van Nuys, CA). J. Appl. Phys.; 45: No. 6, 2668-2671(Jun 1974).

It is proposed that molecular-ion impurities that substitute for the halide ion in alkali-halide crystals constitute an important class of impurities limiting infrared transmission in laser-window materials. A survey of the experimental literature indicates that concentrations of less than 0.1 ppm of NO_3^-, HCO_3^-, SO_4^{2-}, and CrO_4^{2-} will yield an absorption coefficient $\beta > 10^{-4}$ cm^{-1} at 10.6 μm. Predicted temperature dependences of impurity-limited β(10.6 μm) are $T^{1.6}$, nearly temperature independent, and decreasing β with increasing temperature depending on the particular ionic impurity. (auth)

5882 MAGNESIUM FLUORIDE METAL ATOM OXIDATION LASER FROM EXPLOSIVELY GENERATED METAL VAPOR. De Koker, J. G.; Rice, W. W. (Los Alamos Scientific Lab., NM). J. Appl. Phys.; 45: No. 6, 2770-2772(Jun 1974).

Magnesium fluoride laser emission was produced from the chemical reaction of explosively generated magnesium jets and fluorine. The temporal and spectral characteristics of these laser pulses are similar to those reported earlier for the MgF exploding wire laser, i.e., pulse duration of 1 to 3 μs, and wavelength >11μm, which suggests a purely chemical pumping mechanism for both of these metal atom oxidation lasers. (auth)

5883 TRANSVERSE-JUNCTION-STRIPE-GEOMETRY DOUBLE-HETEROSTRUCTURE LASERS WITH VERY LOW THRESHOLD CURRENT. Namizaki, H.; Kan, H.; Ishii, M.; Ito, A. (Mitsubishi Electric Corp., Itami, Japan). J. Appl. Phys.; 45: No. 6, 2785-2786(Jun 1974).

A new geometry DH laser was developed in which a very thin GaAs homojunction laser is sandwiched by (GaAl)As layers. The minimum threshold current is 63 and 80 mA for pulsed and cw operation at room temperature, respectively. The possibility of further reduction of threshold current is briefly mentioned. (auth)

5884 TEST OF A SEMIEMPIRICAL EQUATION DESCRIBING LASER BEAM DIVERGENCE. Bates, H. E.; Phillips, R. W.; Sasser, T. (Martin Marietta Aerospace, Orlando, FL). J. Appl. Phys.; 45: No. 6, 2808-2810(Jun 1974).

A semiempirical equation describing laser beam divergence for a flat-flat laser resonator taking into consideration the resonator Q is tested. This equation describing beam divergence consists of two parts, i.e., a contribution due to diffraction and distortion in the resonator material and a term which accounts for cavity geometry and photon lifetime. Good agreement is obtained with experiment. (auth)

5885 SPONTANEOUS POWER AND THE COHERENT STATE OF INJECTION LASERS. Sommers, H. S. Jr.; North, D. O. (RCA Labs., Princeton, NJ). J. Appl. Phys.; 45: No. 4, 1787-1793(Apr 1974).

A proposed relation between spontaneous and coherent properties of injection lasers is applied to several published results. On experimental and theoretical grounds it is shown that the parameter 1 + X, the ratio of conventional gain coefficient to prorated loss for the strongest cavity mode, can be determined from the spontaneous emission. Over a limited range above unity, 1 + X is the ratio of spontaneous intensity at the operating point to its value at threshold. This supplies a needed experimental connection between spontaneous studies at frequencies higher than the lasing band and the coherent properties. Published data of the current dependence of spontaneous emission are discussed in this framework, and the information needed to intercompare their internal state is pointed out. In general, fundamental differences in laser dynamics should be evidenced by radically different values of the critical parameter P* of the nonlinearity associated with the power dependence of X. All published values of P* are of order 5 mW per cavity mode, as predicted, indicating a similarity in the nonlinearity for quite different types of material. The recent observation that P* is independent of facet area gives strong support to the idea that the source of the nonlinearity is saturable optical absorption in a strongly interacting system. (auth)

5886 PARAMETRIC EXPERIMENTAL AND THEORETICAL STUDY OF A COLD-CATHODE ELECTRON-BEAM-CONTROLLED CO_2 LASER. Hoffman, J. M.; Bingham, F. W.; Moreno, J. B. (Sandia Labs., Albuquerque, NM). J. Appl. Phys.; 45: No. 4, 1798-1805(Apr 1974).

Parametric studies were made of the performance of a 10-liter atmospheric-pressure CO_2 laser system controlled by a 4-μsec pulse of electrons from a cold-cathode gun. The experimental results are compared to the predictions of a theoretical model described in this paper. For various laser gas mixtures and values of E/P the peak small-signal-gain coefficients range up to 4.7% cm^{-1}. Measurements of gain uniformity across the laser medium

and of the time dependence of the small-signal gain are also presented. Operation of the device as an oscillator over a range of parameters has shown that the output pulse typically consists of a sharp gain-switched spike followed by a longer tail with energies up to 30 J in the spike and 200 J in the entire pulse. The theoretical model generally predicts peak small-signal gain well for gas mixtures containing nitrogen; the largest discrepancy is for pure CO_2 gas. The model also predicts the shapes of oscillator pulses satisfactorily. (auth)

5887 CHEMICAL CO AND CO_2 LASERS PRODUCED FROM THE CH + O_2 REACTION. Lin, M. C. (Naval Research Lab., Washington, DC). J. Chem. Phys.; 61: No. 5, 1835-1843(1 Sep 1974).

Strong 5 μm CO laser emission was observed in the flash photolysis ($\lambda \geq 165$ nm) of mixtures of O_2 and $CHBr_3$ in the presence of large amounts of diluent (SF_6, Ar, or He). About 60 vibration-rotation transitions were identified in the range between $\Delta v = 14 \rightarrow 13$ and $2 \rightarrow 1$. The laser intensity was found to vary linearly with flash energy. The effects of various additives (He, Ar, SF_6, CO, N_2, N_2O, and CO_2) were investigated. The stimulated emission is concluded to result primarily from the four-centered reaction $CH + O_2 \xrightarrow{1} CO + OH$, $\Delta H_0^\circ = -159$ kcal/mole. Other possible minor reactions were also considered. No OH emission was detected under the same experimental conditions. With the aid of a band-pass filter (8.6–15 μm range), 10 μm CO_2 emission was observed concurrently with the 5 μm CO emission. The CO_2 emission, which consisted of the P(58)–(70) lines of the (001) → (020) band, was found to vary strongly with the partial pressure of O_2. Since both the intensity of this emission and the yield of CO_2 increased linearly with flash energy, the (001) → (020) CO_2 emission is believed to be the direct consequence of the following CH + O_2 reaction: $CH + O_2 \xrightarrow{10} H + CO_2$, $\Delta H_0^\circ = -184$ kcal/mole. This is the first example of lasing from a chemically produced excited polyatomic molecule. When a small amount of N_2O or CO_2 was added to the O_2–$CHBr_3$–He mixture, the regular (001) → (100) band of both molecules began to lase at ~P(18)–P(28), presumably resulting from the energy transfer process OH + M(000) → OH + M(001), where M = CO_2 or N_2O. (auth)

5888 VOZNIKNOVENIE KVANTOVOI ELEKTRONIKI. (Development of Quantum Electronics). Dunskaya, I. M. Moscow; Izdatel'stvo Nauka (1974). 160p.

The development of quantum electronics from the original basic concepts and ideas up to creation of the first masers and lasers is discussed. This book is the first study in this field both in the USSR and abroad. It is not a simple excursion in the history of science but a significant development both in quantum electronics and in the different concepts and phenomena on which it is based. It is designed for scientists and engineers as well as for students and graduate students. (2 tables, 9 illus-figures, 216 references) (tr-auth)

5889 FREQUENCY SPLITTING OF THE OPPOSITELY TRAVELING WAVES IN A RING LASER WITH A GAUSSIAN DIAPHRAGM. Boitsov, V. F.; Murina, T. A.; Fradkin, E. E. Opt. Spectrosc. (USSR) (Engl. Transl.); 36: No. 3, 311-314(Mar 1974).

Translated from Opt. Spektrosk.; 36: No. 3, 539-545(Mar 1974).

The frequency and spatial distribution of traveling wave amplitude in a ring laser with infinite plane mirrors and a Gaussian diaphragm are determined theoretically. If the length of the tube with the active medium is less than the perimeter of the resonator, then the lasing frequencies of the oppositely traveling waves are different for an asymmetric position of the tube with respect to the diaphragm. The difference between the lasing frequencies is studied as a function of the diaphragm width. (auth)

5890 EFFECT OF SMALL PERTURBATIONS ON THE POLARIZATION OF SINGLE-MODE LASER RADIATION WITH A HOMOGENEOUS LASING TRANSITION LINE. Mazanko, I. P. Opt. Spectrosc. (USSR) (Engl. Transl.); 36: No. 3, 318-320(Mar 1974).

Translated from Opt. Spektrosk.; 36: No. 3, 552-556(Mar 1974).

A stability theory for the polarization of a single-mode laser with respect to steady-state small regular and random perturbations is given. Formulas for computing the natural fluctuations of polarization are presented. (auth)

5891 POLARIZATION AND STATISTICAL PROPERTIES OF LASER EMISSION FROM THE J = 1 → J = 0 TRANSITION. Smirnov, V. S.; Tumaikin, A. M. Opt. Spectrosc. (USSR) (Engl. Transl.); 36: No. 3, 315-317(Mar 1974).

Translated from Opt. Spektrosk.; 36: No. 3, 546-551(Mar 1974).

The effect of depolarizing collisions and radiation trapping on the polarization and statistical properties of emission from the J = 1 → J = 0 transition of a gas laser with an isotropic resonator is considered. The characteristic depolarization time of the circular component, variances in the number of photons, and linewidths of different polarization components are found. (auth)

5892 TRANSIENT PROCESSES AND STATISTICAL PHENOMENA IN A He–Ne LASER WITH A SLOWLY VARYING PUMP PARAMETER. Brazovskii, V. E.; Telegin, G. G. Opt. Spectrosc. (USSR) (Engl. Transl.); 36: No. 4, 429-430(Apr 1974).

Translated from Opt. Spectrosk.; 36: No. 4, 739-742(Apr 1974).

Fluctuations in the time of onset of lasing are detected experimentally from slow variation of the pump parameter in a He–Ne laser at 0.63 μm. There is a large spread in the time of hysteresis cutoff in a laser with nonlinear resonance absorption. Temporal characteristics of certain types of pulsed lasers are discussed. (auth)

5893 SHARP RESONANCES IN A TWO-FREQUENCY GAS LASER. Bagaev, S. N.; Smitriev, A. K.; Chebotaev, V. P. Opt. Spectrosc. (USSR) (Engl. Transl.); 36: No. 3, 307-310(Mar 1974).

Translated from Opt. Spektrosk.; 36: No. 3, 531-538(Mar 1974).

Sharp resonances in a He–Ne laser with a methane cell lasing at 3.39 μm at two frequencies symmetrically located with respect to the absorption line center are obtained experimentally. Frequency stability in this lasing regime is studied. A brief theoretical analysis is given on the shape of the sharp resonances in the two-frequency lasing regime of the gas laser. (auth)

5894 ELECTRON-BEAM-IRRADIATED DISCHARGES CONSIDERED FOR INITIATING HIGH-PRESSURE PULSED CHEMICAL LASERS. Hofland, R.; Lundquist, M. L.; Ching, A.; Whittier, J. S. (Aerospace Corp., El Segundo, CA). J. Appl. Phys.; 45: No. 5, 2207-2218(May 1974).

Volumetric irradiation by a short-pulse electron beam was used to trigger long-duration spatially uniform electric discharges in gas mixtures of He and F_2 or SF_6. Uniform energy deposition to 300 J/liter was observed for atmospheric F_2-He mixtures at nominal electron-beam currents of 3 A/cm^2 and discharge currents up to 20 A/cm^2. Operation suitable for efficient initiation of pulsed HF/DF chain lasers appears possible over a wide range of E/N and mixture ratios, limited by breakdown at large E/N and negligible field enhancement at low E/N. Approximate analytical plasma models are presented and used in conjunction with time-resolved afterglow current measurements to obtain rate constants for F^--ion F_2^+-ion recombination and F_2^+-ion electron recombination. Estimates of F_2 dissociation fractions achieved in the experiments imply the possibility of scalable and efficient initiation of pulsed chemical lasers with such discharges. (auth)

5895 RESONANT-PIEZOELECTRO-OPTIC LIGHT MODULATION. Weil, R.; Halido, D. (Technion-Israel Inst. of Tech., Haifa). J. Appl. Phys.; 45: No. 5, 2258-2265(May 1974).

Experiments were performed on the modulation of CO_2 laser radiation (10.6 μ) at the piezoelectric resonance frequencies of a GaAs sample. The GaAs crystal length was 5.09 cm in the [1$\bar{1}$0] direction with a cross section of 0.291 cm [110] × 0.278 cm [001]. Experimentally, one shear and two thickness vibration modes were observed. The voltages to yield half-wave retardation by means of the piezoelectro-optic effect were found to be 4.15 V at the shear resonance frequency (736.900 kHz) and 15.4 and 51.0 V at the first (675.800 kHz) and second (1019.130 kHz) thickness resonance frequencies, respectively. The bandwidths were in the range 30–100 Hz. When the electro-optic modulation scheme is used instead of the resonant piezoelectro-optic modulation scheme, 5.2 kV are required to obtain half-wave retardation with the same sample. The shape of the sample precluded analytically solvable models for the observed phenomena. However, approximate models yield resonable order-of-magnitude agreement with the observed values. (auth)

5896 OUTPUT FLUCTUATIONS OF HIGH-FREQUENCY PULSE-PUMPED ND:YAG LASER. Jackson, J. E.; Rice, R. R. (McDonnell Douglas Astronautics Co., East St. Louis, MO). J. Appl. Phys.; 45: No. 5, 2353-2355(May 1974).

The output fluctuations of a Nd:YAG laser were determined for high-frequency pulse pumping using GaAlAs injection laser diodes. The results for a 100-mW-output laser show that a very high pump-pulse frequency (≥1 MHz) must be used to achieve quasi-cw output with low ripple amplitude. (auth)

5897 LATE-TIME GAIN OF THE CF_3I IODINE PHOTODISSOCIATION LASER. Palmer, R. E.; Gusinov, M. A. (Sandia Labs., Albuquerque, NM). J. Appl. Phys.; 45: No. 5, 2174-2179 (May 1974).

The gain of the CF_3I iodine photodissociation laser is observed to decrease exponentially with time. The decay rate increases dramatically with a small increase in flashlamp energy. Assuming that the rise in the gas temperature increases as the flashlamp

energy is increased, this indicates that the process causing the decrease in the gain has an activation energy. It appears that CF_3I pyrolysis is the source of the loss in gain, and from the observed decay rate the gas temperature is calculated to be about 1200°K. Measurement of the late-time iodine–iodine recombination rate also yields this temperature. The stimulated-emission cross section measured under the same conditions is $(2.6 \pm 0.5) \times 10^{-18}$ cm^2. (auth)

5898 MODE CONTROL IN GaAs LARGE-CAVITY DOUBLE-HETEROSTRUCTURE LASERS. Hakki, B. W.; Hwang, C. J. (Bell Labs., Murray Hill, NJ). J. Appl. Phys.; 45: No. 5, 2168-2173(May 1974).

Factors that are important in maintaining zero-order-mode operation at high power in large-cavity GaAs double-heterostructure lasers are described. In the first place, it had previously been shown that the electronic gain of the zero-order mode is larger than that of high-order modes when gain is restricted to two-thirds of the waveguide thickness, and the remaining one-third is kept lossy. In practice, this is realized by the LPE growth of a heteroboundary within the cavity such that (a) by the addition of a small amount of aluminum the band gap of the unpumped region is made larger (≈40 MeV) than that of the gain region and (b) the unpumped region is doped with a donor concentration larger than the electron concentration in the gain region at lasing threshold. The second factor that is useful in maintaining zero-order-mode operation at high power levels is the use of a zero-order-mode antireflective (AR) coating that increases the mirror transmission loss for the undesired high-order modes. This zero-order-mode selective AR coating consists of layers of ZnS and Al_2O_3 whose thicknesses are accurately controlled to provide maximum transmission loss at some prescribed angle of emergence relative to the normal axis. Experimental results obtained on zero-order-mode large-cavity PpnN lasers substantiate these design considerations. (auth)

5899 TUNABLE FAR INFRARED METHYL FLUORIDE LASER USING TRANSVERSE OPTICAL PUMPING. Brown, F.; Kronheim, S.; Silver, E. (Williams Coll., MA). Appl. Phys. Lett.; 25: No. 7, 394-396(1 Oct 1974).

Some severe limitations of optically pumped superradiant FIR lasers (700-MHz linewidth, ragged pulse shape) may be overcome by using transverse optical pumping (TOP). Strong (~500 W) lines have been produced in CH_3F with linewidth <30 MHz, and cavity tuning has been achieved over a range of 460 MHz at 496 μm. Prospects for extending the tuning range and increasing the power are considered. (auth)

5900 QUASI-ONE-DIMENSIONAL SOLUTION FOR THE POWER OF CO_2 GASDYNAMIC LASERS. Lee, G. (Ames Research Center, Moffett Field, CA). Phys. Fluids; 17: No. 3, 644-649(Mar 1974).

A theory was developed for calculating the laser power of CO_2 gasdynamic lasers. A three-mode vibrational gas model was assumed and the coupled rate and one-dimensional conservation equations were solved by the time-dependent technique. The results were compared with experimental data and the agreement was good. (auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 6877, 6879–6881, and 6926.

5901 (AD-782394) ELECTRICAL BEHAVIOR OF SUPERCONDUCTING MICROBRIDGES. Skocpol, W. J. (Harvard Univ., Cambridge, Mass. (USA). Div. of Engineering and Applied Physics). Jul 1974. Contract N00014-67-A-0298-0022. 176p. NTIS $5.50.

The experimental behavior of superconducting thin-film microbridges and simple theoretical interpretations of it are presented for a wide variety of conditions. The most important results concern nonequilibrium aspects of cyclical phase-slip processes observed near T_c, and heating effects observed at low temperatures and high voltages. It is shown experimentally that steps in the I-V curves of long superconducting microbridges near T_c are due to spatially localized voltage units (interpreted as quantum phase-slip centers) which appear at local critical currents determined primarily by variations of T_c along the bridge. Also observed is the ac Josephson effect associated with such centers. (auth)

5902 (COM-74-10757-01) SUPERCONDUCTING DEVICES AND MATERIALS. A Literature Survey Issued Quarterly, January–March 1974. Issue No. 74-1. Olien, N. A. (comp.). (National Bureau of Standards, Boulder, Colo. (USA). Inst. for Basic Standards). 1974. 53p.

An extensive list of references on superconducting phenomena, materials, and devices is presented. (WHK)

5903 (CONF-740957-11) SUPERCONDUCTING COIL TRAINING AND INSTABILITIES DUE TO THE BAUSCHINGER EFFECT. Heim, J. R. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). 30 Sep 1974. 10p. Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

For many years the marginal performance of many superconducting coils has been tolerated because of a lack of understanding as to the cause of the observed effects. Study efforts and laboratory experiments have identified electrical losses associated with coil performance but unidentified mechanical losses which generate heat and degrade coil performance have been overlooked. The inelastic behavior of superconducting composite conductors which must be considered if coil performance is to be reasonably evaluated are described. The experimental techniques used and the results obtained are described. The significance of the results is assessed and methods of eliminating mechanical losses are described. A new process for stabilizing the superconductor matrix metal, the PWP process (post wind preload) is presented. (auth)

5904 (LA-UR-74-1413) ADJACENT CONDUCTOR FIELD CORRECTIONS TO HIGH CRITICAL CURRENT SHORT SAMPLE MEASUREMENTS. Miranda, G. A.; Rogers, J. D. (Los Alamos Scientific Lab., N. Mex. (USA)). 30 Sep 1974. Contract W-7405-eng-36. 5p. (CONF-740957-16). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

The critical current of several superconductors to 24 kA was measured in magnetic fields to 4.5 T. The samples were hairpin shaped with the straight section under test in a perpendicularly applied field. The proximity of the straight parts causes the field of the current in one leg to change the applied field in the other leg. The measured results for this adjacent conductor field (ACF) were corrected. These corrections result in data for uniform applied fields. One conductor was used in a 300 kJ magnet. This single-layer, edge-wound coil was rated near 9.8 kA using the uniform field data. Under test the magnet reached 12.5 kA giving no sign of approaching the critical current. The "excess current" is due to the field gradient across the conductor in this coil. One contribution is due to the variation of j_c with the field value within the conductor. A second contribution results from the position dependent anisotropy of the filaments. A third possibility is to change the definition of I_c. The definition was chosen to be the current at which the sample generates an electric field of 3.5 μV/m. If 46 μV/m were chosen, I_c would rise approximately 0.86 kA at 17 kG. (auth)

5905 (LA-UR-74-1473) MAGNETIC FIELD MICROPROBE IN SUPERCONDUCTORS CARRYING A CURRENT. Migliori, A.; Bartlett, R. J.; Taylor, R. D. (Los Alamos Scientific Lab., N. Mex. (USA)). 30 Sep 1974. Contract W-7405-eng-36. 4p. (CONF-740957-15). Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

A new technique to probe local magnetic fields inside superconductors utilizing the Moessbauer effect (ME) is reported. The ME nucleus responds to the local magnetic field resulting in a modified hyperfine ME spectrum from which the local field and its direction may be deduced. Concentrations of a few ppm of the radioactive probe nucleus are sufficient; the allowable depth of the probe depends on the attenuation of the ME γ ray. For ^{57}Fe (^{57}Co parent) in superconductors the field acts directly on the nuclear moment and the resulting sensitivity is only a few kG. For a thin probe consisting of ^{57}Co in Pd the response is enhanced by the "giant" localized moment providing a sensitivity at 1 K of better than 100 G. Results of such a probe placed at various locations across a commercial Nb_3Sn tape carrying a current are reported and compared with calculations of the field profile using several models. For thin tape geometries the usual models prove to be inadequate. (auth)

5906 (NP-20194) SUPERCONDUCTING DEVICES AND MATERIALS. A Literature Survey Issued Quarterly, April–June 1974, Issue No. 74-2. Olien, N. A. (comp.). (National Bureau of Standards, Boulder, Colo. (USA). Inst. for Basic Standards). 1974. 62p. (COM-74-10757-02).

An extensive list of references on superconducting phenomena, materials and devices is presented. (WHK)

5907 (ORNL-TM-4711) CRYOGENIC POWER TRANSMISSION TECHNOLOGY: CRYOGENIC DIELECTRICS. Quarterly Report, April 1–June 30, 1974. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 31p. Dep. NTIS $4.75.

The major experimental progress during the previous quarter involved completion of the negative polarity dc breakdown measurements up to gaps of 2.5 mm (120 kV) in slowly boiling liquid helium, and final reduction and statistical analysis of the entire set of positive and negative dc breakdown data. The results indicate that the dc breakdown strength with sphere-plane electrodes is systematically lower for negative polarity and gaps ranging from 0.25 to 2.50 mm. The average and minimum breakdown fields appear to saturate at values near 400 kV/cm respectively, for gaps greater than 2.00 mm. Further statistical analysis was carried out by members of the ORNL Mathematics-Statistics Research Department (Appendix II). An abstract for a paper on this work (Appendix I) has been submitted for the NAS Conference on Electrical Insulation and Dielectric Phenomena at Downington, Pennsylvania, October 21–23, 1974. Progress has continued in preparations for ac breakdown measurements in liquid helium, and a few preliminary data points have been taken. Further tests were carried out on the Hipotronics 700 kVac test set by factory field engineer R. B. Wilkes. An open high voltage winding was found in Transformer B. Repairs were made, but have proved to be only temporarily successful. Final design drawings were prepared for the 1.2 m diameter High Voltage Cryostat. Construction is underway, and several sub-assemblies have been received. (auth)

5908 NEW GENERATION OF COMPUTERS FORESEEN WITH JOSEPHSON DEVICES. Gilder, J. H. Electron. Des.; 22: No. 2, 30; 32(18 Jan 1974).

Research progress in the use of Josephson devices in logic circuits for fast computers is outlined. Logic delays of less than 100 ps have been measured. (WHK)

5909 FUTURE APPLICATIONS OF LOW-TEMPERATURE. Yonemitsu, H. (Suzuki Shokan K. K., Tokyo). Reito; 49: No. 557, 186-193(Mar 1974). (In Japanese).

Various applied techniques for the use of low temperature are presented. Recently, cryopumping techniques are in the limelight. The cryopump produces clean vacuum by using the low temperature technique, that is, residual gas is adhered to a cryopanel. The exhausting velocity has reached about 5000 l/sec. As the power output of electric generating plants increases greatly, superconducting cables must be used for power transmission. The superconducting cable exhibits its advantages only when the transmission power is larger than about 2 GW because its developing, manufacturing, constructing and operating costs are very high. At present, satellite communication is the only industrial field of low temperature application. Satellite communication is one of cryoelectronics. In every ground station of INTERSAT, parametric amplifiers are employed, and they are cooled at 20°K with helium refrigerators. Superconducting magnets are employed for the technique which can separate weak paramagnetic materials by a strong magnetic field gradient. With this technique, for example, low-grade hematite α Fe_2O can be separated from crushed ore. The other fields to which low temperature is applied are the fields of public nuisance, liquefied fuel, measurement of IR radiation and cryosurgery. (JA)

5910 THERMAL IMPEDANCE ACROSS METALLIC AND SUPERCONDUCTING FOILS BELOW 1°K. O'Hara, S. G.; Anderson, A. C. (Univ. of Illinois, Urbana). J. Phys. Chem. Solids; 35: No. 12, 1677-1682(Dec 1974).

The thermal boundary resistance at the interface between a metal and a dielectric has been investigated using thin foils to avoid the necessity of measuring temperature gradients. Measurements in the normal state are in good agreement with the acoustic mismatch concept of the boundary resistance when the effects of electron-phonon interaction in the metal are included. Since the electron-phonon interaction is reduced or absent in the superconducting state, a change in the boundary resistance is predicted by the acoustic mismatch model. Indeed the measurements in the superconducting state can be understood within the context of the model. However a quantitative interpretation is complicated by the presence of additional phonon scattering attributed to vibrating dislocations. (auth)

5911 CHARACTERISTICS OF A SUPERCONDUCTING POINT CONTACT JOSEPHSON DETECTOR. Selective Mode of Operation. Likharev, K. K.; Semenov, V. K. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 18: No. 12, 1892-1899(Dec 1973).

Translated from Radiotekh. Elektron.; 18: No. 12, 2595-2602 (Dec 1973).

The properties of a superconducting point contact Josephson detector in the selective mode of operation are examined. It is shown that such a detector has significantly different properties for different ratios of the oscillation line width and passband of the matching microwave system. The detector parameters are found for these conditions. (auth)

5912 DETECTION OF ELECTROMAGNETIC RADIATION WITH A SUPERCONDUCTING POINT CONTACT. Vasenko, S. A. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 18: No. 8, 1233-1235(Aug 1973).

Translated from Radiotekh. Elektron.; 18: No. 8, 1694-1697 (Aug 1973).

A theoretical discussion of the problem of detecting high-frequency electromagnetic radiation with a superconducting point contact, obeying the Aslamazov and Larkin model, is presented. An expression is obtained for the power, equivalent to the noise in the far-infrared region. The problem of detecting a nonmonochromatic signal with a point contact is discussed. (auth)

5913 EFFECT OF FLUCTUATIONS ON THE MICROWAVE IMPEDANCE OF SUPERCONDUCTING POINT CONTACTS. Likharev, K. K.; Semenov, V. K. Radio Eng. Electron. Phys. (USSR) (Engl. Transl.); 18: No. 8, 1290-1293(Aug 1973).

Translated from Radiotekh. Elektron.; 18: No. 8, 1757-1759 (Aug 1973).

The effect of fluctuations (inherent contact noise and external pickup) on the impedance of a superconducting point contact that obeys the Aslamazoo and Larkin model is examined. (auth)

5914 VACUUM-TIGHT, ALL-METAL FEEDTHROUGH FOR SUPERCONDUCTING CURRENT LEADS. Mueller, R. M.; Adams, E. D. (Univ. of Florida, Gainesville). Rev. Sci. Instrum.; 45: No. 11, 1461-1462(Nov 1974).

An all-metal feedthrough which permits superconducting leads to pass from the ^4He bath into the vacuum region of a cryostat is described. The all-metal construction facilitates rapid assembly and enables the seal to withstand rapid temperature changes resulting from the precooling of the apparatus with liquid nitrogen. Use of the device is limited to those applications, such as operation of superconducting magnets, in which the presence of normal connections between the various leads or to the metallic structure of the cryostat can be tolerated. (auth)

5915 ELECTROMAGNETIC RADIATION DETECTION BY GRANULAR THIN FILM SUPERCONDUCTORS. Ayer, W. J. Jr. Troy, NY; Rensselaer Polytechnic Inst. (1974). 207p. University Microfilms Order No. 74-26,062.

Thesis (Ph. D.).

Granular thin film superconductors were shown to possess two types of electromagnetic radiation detection mechanisms. One was a thermal or bolometer mechanism, while the other was non-thermal and has been termed the current mode. To study these mechanisms, tin thin films, whose normal state resistances (300°K) were 80 Ω/□, were fabricated by room temperature evaporation onto a glass substrate pre-seeded with a discontinuous 40 Å gold layer. These films were then mounted both in vacuum and directly in helium. In vacuum the thermal conductance to the helium reservoir was adjusted to give medium speed (τ = 50 μsec) bolometer operation. This caused the thermal and non-thermal responses to be of nearly equal magnitude, while still being separable experimentally. The thermal response was shown to be nearly independent of wavelength and to be well described by simple bolometer theory. The current mode, on the other hand, was shown to arise from the interaction of Josephson-like processes with the incident electromagnetic fields. These Josephson-like processes were shown to exist in the films studied by the observation of (a) a series of correlated radiation-induced current steps that exhibited the proper frequency and rf power dependences, and (b) a Josephson-like temperature dependence of the films' critical current. Correlation of a Josephson model with the current mode was achieved by a detailed analysis of electronic structure in the films' current mode responsivity characteristics, while the alternative classical rectification theory was dismissed on the basis of the same experimental data. Additionally, detection measurements in the far infrared placed the short wavelength cutoff for the current mode in tin between 0.337 and 7.5 mm. The films of niobium nitride were also examined. These films were prepared by evaporating niobium in an activated nitrogen atmosphere onto glass substrates. This method produced films with a maximum superconducting critical temperature of 9.8°K at an optimum atomic impingement ratio (N/Nb) of approximately 2.5 for a substrate temperature of 500°C. This low T_c probably represents an impurity limit, since background pressures of only 10^{-6} Torr could be achieved. The superconducting NbN films were then shown to possess both thermal and non-thermal modes of electromagnetic radiation detection similar to granular thin films of tin. A careful study of films that did not go superconducting, however, showed that this condition could be correlated with the apparent localization of electronic states in the interislandic regions. (Diss. Abstr. Int., B)

5916 CURRENT FEEDING ARRANGEMENT FOR ELECTRICAL APPARATUS HAVING LOW TEMPERATURE COOLED CONDUCTORS. Schmidt, F.; Matthaus, G.; Massek, P. (to Siemens Aktiengesellschaft). US Patent 3,835,239. 10 Sep 1974. Priority Date 27 Dec 1971, F. R. Germany. 6p.

A current feeding arrangement for a superconductor, having a cooled standard conductor connected to it is described. The invention is comprised of adding an electronegative gas, a vaporous radical or Freon to the gaseous cooling medium, which increases the dielectric strength of the gaseous cooling medium making the current feeding arrangement suitable for high voltages. (8 Claims, 2 Drawing Figures) (Official Gazette)

Heat Transfer and Fluid Flow

Refer also to abstracts 7486, 7652, 7714, 7715, 7726, and 7809.

5917 HEAT PIPE RESEARCH AND DEVELOPMENT AT INSTITUT FUER KERNENERGETIK, UNIVERSITAET STUTTGART. Groll, M. (Stuttgart Univ. (TH) (F. R. Germany). Inst. fuer Kernenergetik). Klima Kaelteing.; 2: No. 7, 63-66(Jul 1974). (In German).

4 figs.; 1 tab.; 10 refs.

Heat pipes are relatively novel heat transfer devices finding a steady growing application. Their physical principles and characteristic performance data are described. Heat pipe research and development at Institut fuer Kernenergetik, Universitaet Stuttgart is presented. Some heat pipe applications are discussed. (auth)

5918 STATISTICS OF FAILURES IN SMALL-SIZE AND MEAN-SIZE STEAM BOILERS IN THE FEDERAL REPUBLIC OF GERMANY DURING 1971. Maschinenschaden; 46: No. 6, 187-188(1973). (In German).

1 tab.; 1 ref.

For the first time the attempt has been made by the technical surveillance associations to statistically evaluate failures in steam boiler plants in the year 1971 with the help of stored data in a data processing plant. To do this, 312 reported failure cases have been broken down by various view-points in order to make clear the certain tendencies and important points of the failure development. (GE)

5919 HEAT TRANSFER TO BOILING WATER IN ROUGH STEEL TUBES. Upmalis, A. Waerme Stoffuebertrag.; 6: No. 3, 160-164(1973). (In German).

5 figs.; 9 refs.

For computation of heat transfer from the tube wall to boiling water inside the tube, several types of expressions are reported in the literature which are applicable to a limited, not always exactly defined range of pressures. A new empirical expression is described in the present note which may be used with good results for computation of heat transfer coefficients at ranges of pressures from 1 to 120 bar and from 170 to 210 bar. (auth)

5920 UNEQUAL PHASE VELOCITY MODELS OF ANNULAR-DISPERSED FLOW. Farman, R. F.; McFadden, J. H. (Aerojet Nuclear Co., Idaho Falls, ID). Trans. Amer. Nucl. Soc.; 19: 161(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5921 COLLOCATION METHOD USING HERMITE CUBIC SPLINES FOR NONLINEAR TRANSIENT ONE-DIMENSIONAL HEAT CONDUCTION PROBLEMS. Chawla, T. C.; Leaf, G.; Chen, W. L.; Grolmes, M. A. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 162-163(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5922 SOLUTION OF THE HEAT DIFFUSION EQUATION BY MONTE CARLO. Troubetzkoy, E. S. (Mathematical Applications Group, Inc., Elmsford, NY); Banks, N. E. Trans. Amer. Nucl. Soc.; 19: 163-164(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5923 EXTENSION OF THE SURFACE-DENSITY MONTE CARLO TECHNIQUE TO HEAT TRANSFER IN NONCONVEX REGIONS. Hoffman, T. J. (Science Publishers, Inc., Huntsville, AL); Banks, N. E. Trans. Amer. Nucl. Soc.; 19: 164 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5924 STATISTICAL CONSIDERATIONS IN HETEROGENEOUS TWO-PHASE FLOWING SYSTEMS. Jones, O. C. Jr. Troy, NY; Rensselaer Polytechnic Inst. (1974). 658p. University Microfilms Order No. 74-26,079.

Thesis (Ph. D.).

Experimental data were obtained for vertical upflow of an adiabatic, air-water mixture in a rectangular, ten-foot long 0.2×2.5-inch duct. Pressure and temperature were near standard conditions. Information obtained for volume fluxes of zero to 10 fps for water and zero to approximately 120 fps for air included: (a) test section pressure drop data, (b) using anemometry techniques across the small dimension; (1) void residence time fraction profiles, (2) volume flux profiles, and (3) interface passage frequency profiles; (c) using transient X-ray equipment; (1) transverse large dimension void fraction profiles, (2) centerline measurement of void fluctuation spectra, and (3) centerline measurement of void fluctuation probability density functions. (TFD)

5925 MEASUREMENT OF TRANSIENT CRITICAL HEAT FLUX BY FLUID MODELING. Shih, T. D. Ames, IA; Iowa State Univ. of Science and Tech. (1974). 136p. University Microfilms Order No. 74-23,767.

Thesis (Ph. D.).

A fluid modeling technique based on dimensional analysis has been developed to predict experimentally the onset of transient critical heat flux in a high pressure, high power water system such as a light water nuclear reactor. By the use of a fluid with lower latent heat of evaporation, the technique allows one to conduct the necessary experiments with much more economical facilities than the out-of-pile mock up of a water system. As a result of the analysis, a compensated distortion model was built with 36-in. inner heated annular test section and Freon-11 (CCl_3F) was used as a modeling fluid. This model was used to perform a series of experiments for testing the validity of the modeling technique in transient two-phase systems. Steady-state critical heat flux tests were first conducted to provide the values of system parameter scales. Based on these scales, tests were then performed for transient critical heat flux predictions. Comparison of the experimental results with those obtained using MAYU-2 code calculations reveals that the onset of transient critical heat flux in water system can be predicted from the compensated distortion model. (Diss. Abstr. Int., B)

5926 POOL BOILING CRITICAL HEAT FLUXES IN SLOWLY VARIABLE TRANSIENT STATES. Fontana, D. M. (Univ., Rome). Int. J. Heat Mass Transfer; 17: No. 11, 1411-1412(Nov 1974).

Pool boiling critical heat fluxes were investigated under transient conditions for durations of power transients of the order of tens of seconds. Experiments performed in distilled, deaerated, and saturated water, at atmospheric pressure are briefly described. Values of the critical heat flux Q_{cr} were found, on average, to be higher than those relative to the steady state if the duration of the transients was 2 min or less. For the shortest transient tested the difference between transient and steady values reached 25%. It is concluded that the observed trend for Q_{cr} is of little relevance for practical applications but seems important mainly in relation to problems of heat flux measurement. (UK)

Materials Testing

Refer also to abstracts 6022, 6541, 6607, and 6674.

5927 (COM-74-10871) ACOUSTIC HOLOGRAPHY. A Bibliography with Abstracts. Report for 1964-March 1974. Craig, D. M. (National Technical Information Service, Springfield, Va. (USA)). Apr 1974. 69p. (NTIS-WIN-74-027). NTIS $20.00.

The bibliography contains 64 selected abstracts of research reports retrieved using the NTIS On-Line Search System-NTISEARCH. The topics covered include techniques of acoustic holography including microwave, seismic wave, and ultrasonic imaging and their applications. The applications include underwater and underground object locating, structural geology and tectonics, sonar imaging, nondestructive testing, antenna radiation patterns, nuclear reactor inspection, remote sensing, and a use in medical examinations. (auth)

5928 (IFA-M-48-1974) NEW TRENDS IN NONDESTRUCTIVE TESTS WITH PENETRATING RADIATIONS. Panaitescu, I. (Institutul de Fizica Atomica, Bucharest (Romania)). 1973. 13p. (In French). (CONF-7309125-1). Dep. NTIS (US Sales Only) $4.00.

From seminar on physics; Turin, Italy (11 Sep 1973).

The concepts of the information theory have started to affect developments in a classical technical region, that of industrial radiography. It is understood that the limits of the radiological detection of defects are determined by the signal (contrast)/background (granularity) ratio and by the frequency band trans-

mitted. The present-day detectors allow an improvement of the signal/noise ratio if the frequency band is reduced. The present study summarizes the recent progress in methods such as scanning scintigraphy, extraction of radiological data by optical filtering, automation of the radiological control, each of which in a specific manner attempts to lower the detection limits. A brief summary is given of work currently under study at the Bucharest Institute of Atomic Physics. (tr-auth)

5929 (NASA-SP-5931(02)) TESTING METHODS AND TECHNIQUES. A Compilation. (National Aeronautics and Space Administration, Washington, D. C. (USA)). [nd]. 29p. NTIS $1.00.

The National Aeronautics and Space Administration and the Atomic Energy Commission have established a Technology Utilization Program for the dissemination of information on technological developments which have potential utility outside the aerospace and nuclear communities. By encouraging multiple application of the results of their research and development, NASA and AEC earn for the public an increased return on the investment in aerospace and nuclear research and development programs. This Compilation of Testing Methods and Techniques has been divided into four categories: (1) Mechanical Testing Techniques, (2) Electrical and Electronics Testing Techniques, (3) Thermal Testing Techniques, and (4) Optical Testing Techniques. In general, the Compilation items are moderately complex and appeal to the applications engineer. However, selection criteria were such that the items reflect fundamental design principles and applications, with the additional requirement of simplicity whenever possible. Additional technical information on the individual devices and techniques described can be requested by circling the appropriate number on the Reader Service Card included in the Compilation. (auth)

5930 THE FINITE-ELEMENT METHOD FOR STRESS ANALYSIS OF STRUCTURAL COMPONENTS SUBJECT TO INSPECTION. Dittmar, S. (Technischer Ueberwachungs-Verein Rheinladd e.V., Koeln (F. R. Germany). Abt. Vorpruefung udd Bauteilauslegung). VGB Kraftwerkstechnik; 54: No. 6, 411-418 (Jun 1974). (In German).

11 figs.; 12 refs.

In the case of many structural components and plants subject to inspection, only stresses below the yield point are permissible. The Finite-Element Method considerably increases the possibilities of stress analysis and consequently also of safety clearance. (GE)

5931 UNIFORM ULTRASONIC INSPECTION OF FUEL SHEATH TUBING. Cross, B. T. (General Electric Co., San Jose, CA); Abbott, D. J. Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 31-38(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Ultrasonic nondestructive inspection of fuel tubing can be made far more uniform and reliable by placing proper priority on the various test parameters. Search units, for example, should be designed specifically for a given tube size, tube material, and quality assurance specification. It is common practice to select a standard product line search unit and juggle test parameters until some semblance of a test is achieved. Through an in-depth study of tubing inspection requirements, it has become evident that arbitrarily selected search units rarely satisfy the requirements for tubing inspection. "Spectral compatibility" in an ultrasonic inspection system is as important in achieving realistic test results as proper selection of search units. This often ignored parameter is one of the keys to uniform reproducible inspection results. Discussions are presented of these significant test parameters, how they are used, and their relation to the current ultrasonic inspection procedures being used in American Society for Testing and Materials Committee B-10 on Reactive and Refractory Metals and Alloys. (auth)

5932 DEFECT SENSITIVITY IN LAMB WAVE TESTING OF THIN-WALLED TUBING. Wiklund, J. (Sandvik AB, Sandviken, Sweden). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 39-51(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Ultrasonic testing of fuel cladding usually involves the use of moderate-frequency search units. The relatively thin wall, small radius of curvature, wave length, and physical size of sound beam are considerations in describing the predominant type of ultrasonic wave resulting and the nature of the energy reflection process at a defect. Shear and Lamb waves are generally assumed to be the main wave forms pertinent to fuel clad testing. The observed waves are discussed with regard to their nature and ability to permit excitation over wide incident angle ranges and to such properties as attenuation and sensitivity to some types of defects. General Lamb wave theory is not sufficient to explain the behavior of the waves. A new model describing a surface wave or possibly a degenerated Lamb wave is outlined and discussed with reports of laboratory measurements as well as observations from practical testing using both echo technique and through-transmission. (auth)

5933 NONDESTRUCTIVE INSPECTION OF PIPELINES. Ishii, Y. (Tokyo Inst. of Tech.). Yosetsu Gakkaishi; 43: No. 2, 215-220(Feb 1974). (In Japanese).

Nondestructive inspection (NDI) standards for welding are described. These standards were applied to the installation of pipelines between Yokohama and Omiya via Hachioji by the Japanese National Railways (JNR). They were prepared from the viewpoint of taking the standard A for static load and the standard B for the components subjected to fatigue or unstable destruction. NDIS-0401-71 standard is applied to the NDI of one side welding of butt joints in pipelines in the field. Standard A is applied to general pipes and inspection is carried out on every welded part by radiography. Standard B is applied to the specific parts of pipes, and all welded parts are tested by radiography, ultrasonic, and magnetic powder flaw detection. The standards for the pipelines of JNR were made by modifying the above-described NDIS. The following additional problems will be further investigated: review of the inconsistency between each judgement criterion, clear definition of independent defects, consideration for the pipelines passing through city area, etc. (JA)

5934 RADIOGRAPHY USING SCATTERED GAMMA-RAYS. II. Tsujii, Y.; Furuta, J.; Hiraoka, E. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 60-62(1973).

Radiography of the lining metal attached to concrete walls was attempted using a backscattered radiation generated in the concrete wall. Trials to increase the image quality and to shorten the exposure times are reported. The best radiographic quality is obtained by the following conditions: collimator size, 50 × 50mm; shielding distance, 50mm; and intensifying screen, lead foil 0.1mm. (auth)

5935 APPARATUS FOR THE TENSILE TESTING OF CERAMIC RING SPECIMENS AT ELEVATED TEMPERATURES. Ainscough, J. B.; Messer, P. F. (United Kingdom Atomic Energy Authority, Springfield, Eng.). J. Phys., E (London); 7: No. 11, 937-939(Nov 1974).

The construction of an apparatus to measure the tensile strength of ceramic specimens in the form of thin-walled rings is described. In its present form it has been used satisfactorily on sintered polycrystalline UO_2 up to 500°C with either putty or low softening point glass as the pressurizing medium. Since the major problem preventing use at higher temperature appears to be oxidation of the specimens, the equipment, even in its present form, could possibly be used at appreciably higher temperatures with less oxygen-sensitive materials. (auth)

5936 HANDBOOK OF RADIOGRAPHIC APPARATUS AND TECHNIQUES. Second Edition. Cambridge, Eng.; Welding Institute (1973). 111p.

The book covers the following topics: characteristics and properties of X- and gamma-rays, and types of radiation source for X- and gamma-rays; radiographic films and their processing; radiation safety of equipment; setup of apparatus; production of radiographs of welds; interpretation of radiographs, including image quality assessment and localizing defects in depth; and radiation protection from X- and gamma-rays. (UK)

5937 PIPE WELD INSPECTION METHOD AND APPARATUS. Weigle, O. C. US Patent 3,835,324. 10 Sep 1974. Filed Date 4 Oct 1972. 8p.

An illustrative embodiment of the invention includes method and apparatus for pipe weld seam inspection. A gamma ray source of relatively low intensity is disposed on the interior portion near the center of a pipe section being inspected. A gamma ray detector comprising an activated scintillating crystal and a photomultiplier tube is traversed in a track on an elastomeric belt about the circumference of the pipe and maintained adjacent said weld seam at all circumferential points. The intensity of the gamma radiation penetrating the weld seam is sensed and recorded as a function of the circumferential location of the detectors. This recording may then be interpreted in terms of the material density of the weld at all circumferential points on the seam. (7 Claims, 3 Drawing Figures) (Official Gazette)

Nuclear Explosions

Refer also to abstracts 6169, 6172, and 6297.

5938 (AD-783246) PROPAGATED EMP FROM TANGENT AND BURIED BURSTS. Final Report, March–December 1973. Brau, J. E.; Canavan, G. H.; Wittwer, L. A.; Greene, A. E. (Air Force Weapons Lab., Kirtland AFB, N. Mex. (USA)). Jul 1974. 30p. (AFWL-TR-74-47). NTIS $3.25.

Calculations describing the ionospheric propagation of high-altitude electromagnetic pulses (EMP) to satellite altitudes are reported. Both tangent and buried burst scenarios are treated. The calculations are based on the AFWL CHEMP code for self-consistent calculations of radiated EMP, modified by the inclusion of a SWARM treatment of secondary and ionospheric electrons. The region of applicability of this SWARM treatment has been determined by a separate Monte Carlo calculation. By carrying the calculations all the way from the burst point through the E region, the authors are able to account fully for the D region heating, the increased absorption and cascading it produces, and the increased cutoff frequency which results. The code calculations are evaluated for sensitivity to the ambient ionospheres used. (auth)

5939 (AWRE-O-9/74) PEACEFUL USES OF NUCLEAR EXPLOSIVES. Review Paper No. 7. Geometry of Craters Formed by Single Nuclear Explosions. Neeves, K. F. (UKAEA Weapons Group, Aldermaston. Atomics Weapons Research Establishment). Nov 1974. 29p. Dep. NTIS (US Sales Only) $4.50. UK 50 pence.

The subject is dealt with under the following headings: available data (nuclear cratering, results of high explosive (HE) experiments); crater formation (size and type, the medium, depth and yield); prediction of crater size and shape; retarcs; subsidence craters. (UK)

5940 (FOA-C-20010-T1) SEISMIC MAGNITUDES FROM EXPLOSIONS AND EARTHQUAKES OBTAINED AT THE HAGFORS AND MATSUSHIRO OBSERVATORIES. Israelson, H.; Yamamoto, M. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Sep 1974. 23p. Dep. NTIS (US Sales Only) $4.25.

A set of seismic events has been acquired with body (m_b) and surface (M_s) wave magnitudes determined at the Hagfors (HFS) and Matsushiro (MAT) Observatories. A systematic search of seismic events in mainland USSR was performed. In all, 7 presumed underground nuclear explosions and 23 shallow earthquakes were found with $m_b(M_s)$ determinations at both stations. This is only about 25% of the events that had $m_b(M_s)$ data at least at one of the two stations and this illustrates the difficulty of establishing significant common data bases. Differences between the $m_b(M_s)$ values at the two stations were observed. The difference in m_b was found to be a function of the periods of the short period P-waves and at shorter period the m_b values at HFS were consistently larger than at MAT. This may be accounted for by different structures underneath the two stations. The difference in M_s, which was most pronounced for explosions, can largely be ascribed to different instrumental responses and to different travel paths. (auth)

5941 (FOA-P-C-8405) COMPUTERIZED NUCLEAR EXPLOSION INDEX. Tikkanen, T. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Jun 1974. 100p. Dep. NTIS (US Sales Only) $8.00.

This report describes the index of nuclear explosions, designed at the Research Institute of Swedish National Defence. The index is run on a computer with the information retrieval system CORSAIR, developed at the Research Institute. Searches and input in the about 900 references (February 1974) via terminal are made by using ISIS (Integrated Scientific Information System). The report also includes users guidance, both concerning the handling of the terminal and the filling out of forms to update the index. The system is run on a computer type IBM 360/75. CORSAIR is an acronym for Computer Oriented Reference System for Automatic Information Retrieval. (auth)

5942 (JAB-99-114) LOW-RISE BUILDING SOIL-STRUCTURE INTERACTION PARAMETER STUDY. Reed, J. W. (URS/John A. Blume and Associates, Engineers, San Francisco, Calif. (USA)). Oct 1974. Contract AT(26-1)-99. 77p. Dep. NTIS $7.00.

This report presents the formulation and results of a low-rise building soil-structure interaction parameter study that considers 1- and 2-story structures typical of residential construction. An analytical model and the procedures for selecting model parameters as obtained from prototype building properties are developed. The peak acceleration of the structure model mass is selected as the measure of potential damage for low-rise buildings. Using this response parameter, the effects of foundation flexibility are presented for two building case situations. In Case I, damage potential is examined for identical buildings placed on foundations with varying degrees of flexibility. Case II compares predicted damage based on a soil-structure interaction model with damage based on a rigidly supported model having the same fundamental natural period and critical damping ratio. Case II investigates the possible error that might occur if the gross system dynamic properties (period and damping) are known but the building is considered to be supported by an infinitely rigid base. In short, Case II examines the building response error caused by neglecting the contribution of the soil-structure mode shape and mass participation effect. The conclusion of this study is that it is reasonable to neglect the system amplification effects of soil-structure interaction when predicting damage for typical low-rise buildings subjected to ground motions caused by underground nuclear explosions. This conclusion is based primarily on the observation that the uncertainty in predicting ground motion and damage is large when compared to the effects of soil-structure system amplification on low-rise building response. It is sufficient to know the system period and damping ratio values, which for a particular building can be easily determined experimentally. The effects of settlement, land sliding, and ground cracking on damage are not considered in this report. (auth)

5943 (NVO-145(Rev.1)) DEFINITION PLAN: ALTERNATE REENTRY AND TESTING. Project Rio Blanco. (Continental Oil Co., Houston, Tex. (USA)). Sep 1974. 95p. (PNE-RB-57(Rev.1)). Dep. NTIS $5.45.

This Project Definition Plan modifies the reentry program described in Project Rio Blanco Definition Plan, Vol. III, Reentry-Related Detailed Tasks, January, 1973 (PDP Vol. III), and describes the drilling, production testing, formation sampling safety, security, and environmental programs, as well as the project management aspects of the alternate reentry project. The plan is, however, subject to modification as dictated by circumstances encountered during the field activity. Drilling will be accomplished in two phases. The first phase will be the drilling and casing of a 2,200-ft vertical hole. The second phase will extend the hole to approximately 4,700 ft where it will be directionally drilled toward the detonation point of the middle chimney in RB-E-01. The hole will intersect the lower chimney region at about 45° from the vertical, and be used for drawdown testing and the gathering of data that should define chimney characteristics. These data will assist scientists and engineers in interpreting detonation-related phenomena with respect to low productivity observed during the drawdown testing of the upper chimney. The major technical objectives of this program are to: (1) evaluate the stimulation of the tight gas sands in connection with the second nuclear chimney and possibly the bottom chimney; (2) determine the chimney, fracture, and formation characteristics from flow test and pressure buildup data; (3) investigate the radial extent of fracturing while drilling; (4) investigate the chemistry and radiochemistry of the produced gas; and (5) determine detonation-related geometry of the lower chimney region such as chimney and cavity radius; any mineralogical changes in the rock properties; fracture distribution as deduced from studies of micro- and macrofractures; distribution of melt and the HTO content of melt samples if economically and technically feasible; (this information will be determined from drilling, logging, and possibly core sampling. The acquisition of this information will depend on the drilling and hole condition encountered while drilling). (TFD)

5944 (NVO-148) PROJECT RIO BLANCO DATA REPORT: PRODUCTION TESTING (RB-E-01), NOVEMBER 1973 AND JANUARY–FEBRUARY 1974. (Continental Oil Co., Houston, Tex. (USA)). Sep 1974. 96p. Dep. NTIS $4.00.

Project Rio Blanco is a government-industry gas reservoir stimulation experiment using three 30-kiloton nuclear explosives, which were detonated simultaneously in a single well, RB-E-01, at depths of 5,838.5, 6,229.7, and 6,689.5 feet. After completion of reentry drilling, initial drawdown testing was performed in two phases: the first phase was conducted during November, 1973, and the second phase during January–February, 1974. Production of approximately 300 million cubic feet of gas had been planned, but a total of only 98 million (dry gas) was produced. Furthermore, most, if not all, of the gas produced came from the top chimney because there is apparently no significant evidence of communication between the top and the two lower chimneys. The testing of the entire section was therefore considered inconclusive and alternate reentry operations began in May, 1974. Data obtained during the November, 1973, and January–February, 1974, testing periods are presented. The data given include daily gas and water production rates, total gas and water production, radiochemical analysis, drawdown and buildup temperature and pressure history, and other relevant production data. (TFD)

5945 (NVO-149) DEFINITION PLAN: TESTING AND EVALUATION OF THE FORT UNION FORMATION. Project

Rio Blanco. (Continental Oil Co., Houston, Tex. (USA)). Oct 1974. 20p. (PNE-RB-62). Dep. NTIS $4.00.

The Project Definition Plan describes the RB-U-4 well for testing and evaluating the Fort Union Formation in the Rio Blanco Event. The drilling, production testing, program management, technical documentation and reporting, and public affairs aspects of the program are described. (TFD)

5946 (PB-233163) COMPUTERIZED NUCLEAR EXPLOSION INDEX. Tikkanen, T. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). Jun 1974. 99p. (FOA-P-C-8405-M7). NTIS $8.00.

The report describes the index of nuclear explosions, designed at the Research Institute of Swedish National Defence. The index is run on a computer with the information retrieval system CORSAIR, developed at the Research Institute. Searches and input in the ~900 references (February 1974) via terminal are made by using ISIS (Integrated Scientific Information System). The report also includes users guidance, both concerning the handling of the terminal and the filling out of forms to update the index. The system is run on a computer type IBM 360/75. (GRA)

5947 (PB-778950) LONG-PERIOD SEISMOLOGICAL RESEARCH PROGRAM. Semiannual Report. Sykes, L. R.; Savino, J. M. (Columbia Univ., Palisades, N.Y. (USA). Lamont-Doherty Geological Observatory). 29 Oct 1973. Contract F44620-71-C-0082. 27p. (AFOSR-TR-74-0743). NTIS $3.25.

Contents include station maintenance, focal mechanisms of small magnitude events, detection capabilities of the vlp stations, detection thresholds versus epicentral distance, and general seismological investigations. (GRA)

5948 (SAND-74-8234) PLOWSHARE PROGRESS REPORT FOR QUARTER ENDING SEPTEMBER 30, 1974. (Sandia Labs., Livermore, Calif. (USA)). Oct 1974. Contract AT(29-1)-789. 6p. Dep. NTIS $4.00.

Research progress is reported on high temperature arming and firing components, control switches, destruct system, and safe-secure trailer. (TFD)

5949 (UCID-15995) EXAMINATION OF THE EFFECTS OF A NEARBY BOUNDARY ON RESULTS FROM PERMEABILITY TESTS. Morris, G. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Mar 1972. Contract W-7405-eng-48. 9p. Dep. NTIS $4.00.

The flow of gas through the media surrounding nuclear device tests is important in the evaluation of containment. One of the properties of the media of interest being investigated is the permeability. Tests have been proposed in which two tubes 2 in. in diam and 20 ft long would be emplaced into the media from a shaft or face. The tubes would be 4 ft apart, one tube would be used as an air injection tube and the other tube used as a pressure monitoring point. The result of calculations to see what effect the wall has on the monitor hole pressure history and what error is introduced assuming a spherical infinite media model for data reduction rather than a cylindrical model are presented. Calculations are for short times (less than 15 min). These calculations are used to establish guidelines only and are not used for actual test runs. (auth)

5950 (UCID-16071) ESTIMATED CLOSE-IN SURFACE MOTION FOR PROJECT RIO BLANCO. Jackson, E. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 26 Jun 1972. 11p. Dep. NTIS $4.00.

Surface ground motion for areas within five miles of the Rio Blanco Event is predicted. (TFD)

5951 (UCID-16165) HIGH-PRESSURE EQUATION-OF-STATE MEASUREMENTS FOR ALTERED BASALTS AND BRECCIAS FROM AMCHITKA ISLAND, ALASKA. Heard, H. C.; Stephens, D. R.; Schock, R. N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Dec 1972. Contract W-7405-eng-48. 18p. Dep. NTIS $4.00.

Hydrostatic and quasi-hydrostatic pressure-volume data, uniaxial-compression failure envelopes, and effective moduli as determined in uniaxial strain have been measured for a suite of altered basalts and breccias from the Cannikin site. Values of 350 kb for the bulk modulus and 0.3 for Poisson's ratio are representative at the working point. Shear strengths range from 0.5 to 1.5 kb at mean pressures up to 8 kb. (auth)

5952 (UCID-51671) COMPARISON OF INITIAL CONDITIONS FOR NUCLEAR EXPLOSION CALCULATIONS. Schroeder, R. C. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Oct 1974. Contract W-7405-eng-48. 13p. Dep. NTIS $4.00.

A series of nuclear-explosion calculations was carried out with the one-dimensional rock-mechanics computer program SOC73. The calculations are used to compare the effect of several different initial conditions. The results are compared with experimental data. (auth)

5953 (UCRL-51620) PROJECT DIAMOND ORE, PHASE IIA: CLOSE-IN MEASUREMENTS PROGRAM. Sisemore, C. J.; Burton, D. E.; Bryan, J. B. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 28 Aug 1974. Contract W-7405-eng-48. 61p. Dep. NTIS $4.00.

Project Diamond Ore was designed to determine the effects of stemming, depth of burial, and geology on nuclear and high explosive cratering phenomena. Phase IIA included three multi-ton chemical explosive cratering events. The close-in instrumentation for these events provided data to further code development work and to determine detonation histories. The instrumentation plan and emplacement procedures are described, and the recorded waveforms are reported, summarized, and interpreted in detail. (auth)

5954 (UCRL-51659) NUMERICAL STUDIES OF CRATERING IN BEARPAW SHALE: TWO-DIMENSIONAL RESULTS. Bryan, J. B.; Burton, D. E.; Denny, M. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Oct 1974. Contract W-7405-eng-48. 57p. Dep. NTIS $5.45.

The computer calculations described in this report were performed to simulate cratering phenomena associated with subsurface detonations in Bearpaw clay shale. These calculations and a complementary field program were part of Project Diamond Ore. A cratering equivalence between nuclear and high explosives was established using the SOC and TENSOR stress-wave-propagation computer codes for dynamic modeling. Late-time ballistic and fall-back modeling were utilized to define the final crater configurations. It was found necessary to run each calculation to at least 20 ms to get an accurate final representation. Stemmed cratering calculations made at three burial depths (6, 12.5, and 17 m) and two source energies defined calculated nitromethane cratering curves which closely matched empirical curves. A hypothetical 20-ton nuclear source was analyzed in stemmed and unstemmed configurations. The cratering dynamics and final crater shapes were nearly the same for the 20-ton nuclear and 10-ton nitro-methane stemmed sources, the crater dimensions and volumes differing by less than ±5%. (auth)

5955 (UCRL-51668) ANALYSIS OF THE GROUND MOTION FROM RIO BLANCO. Germain, L. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Sep 1974. Contract W-7405-Eng-48. 16p.

Project Rio Blanco is a government-industry gas-reservoir stimulation experiment using three 30-kt (125-TJ) nuclear explosives detonated simultaneously in a single well bore, at depths of 1780, 1900, and 2040 m (5840, 6230, and 6690 ft). The detonation occurred at approximately 10:00 a.m. Mountain Day-light Time on May 17, 1973. As a part of the project, 36 locations were instrumented for ground motion by the U. S. Geological Survey/Seismic Engineering Branch (USGS/SEB). Data resulting from these measurements have been published by the Environmental Research Corporation (ERC). In particular, distance, bearing, and peak amplitudes for acceleration, velocity, and displacement are given for each station. These data, and similar data from the other gas stimulation experiments, Gasbuggy and Rulison, are subjected to further analysis in this report. (auth)

5956 (UCRL-51680) EARLY TIME FIREBALL GROWTH FROM A NUCLEAR EXPLOSION. Nutt, G. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Oct 1974. Contract W-7405-Eng-48. 10p. Dep. NTIS $4.00.

The early motion of an x-ray fireball from a nuclear detonation in the atmosphere is studied using the equations of radiation transport coupled to the equations of hydrodynamics. The solutions are compared with observations of fireball motion in a free homogeneous atmosphere and near the ground surface. This comparison permits the determination of the amount of energy coupled to the ground by means of x-ray deposition from a surface shot. (auth)

5957 IGNITION PROBLEM IN FISSION-TRIGGERED THERMONUCLEAR MICRO-EXPLOSION POWER SYSTEMS. Seifritz, W. (Swiss Federal Institut for Reactor Research, Wuerenlingen). Trans. Amer. Nucl. Soc.; 19: 10(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5958 COMPREHENSIVE MODEL FOR INITIAL WEAPONS RADIATION ENVIRONMENTS. Guy, R. W.; Albert, T. E.; Straker, E. A. (Science Applications, Inc., Huntsville, AL). Trans. Amer. Nucl. Soc.; 19: 452(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Protective Structures and Equipment

Refer also to abstracts 5958 and 7452.

5959 (LA-5758-PR) RESPIRATOR STUDIES FOR THE AEC DIVISION OF OPERATIONAL SAFETY. Progress Report, January 1–June 30, 1974. Held, B. J.; Richards, C. P.; Revoir, W. H.; Bevis, D. A.; Moore, T. O.; Davis, T. O.; Hyatt, E. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 16p. Dep. NTIS $4.00.

Major accomplishments during the second half of FY 74 include completion of development of the DOS Respirator Guide; assisting AEC contractors, including on-site assistance in installing and evaluating new respirator test equipment; providing information to AEC contractors concerning respirator programs, quality assurance of respirators, and respirator application recommendations; and giving respirator training to AEC Operations Office and AEC contractor personnel. (auth)

5960 EXPEDIENT FALLOUT SHELTERS IN RURAL AREAS. Cohen, M. O.; Beer, M. (Mathematical Applications Group, Inc., Elmsford, NY). Trans. Amer. Nucl. Soc.; 19: 452-453(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

ENVIRONMENTAL AND EARTH SCIENCES

5961 ENERGY AND THE ENVIRONMENT. London; Royal Society of Arts (1974). vp. £ 3.

The report is in chapters dealing with different aspects of the subject, under the following headings: political issues; the effect on landscape; social consequences; radiation; air pollution; pollution of the sea and shore; pollution of rivers and estuaries; thermal pollution; the environmental effects of renewable sources of energy; energy, the environment and public policy. The chapter on radiation was in NSA scope and a separate abstract was prepared for it. (UK)

For an abstract of an individual chapter see: 5965.

Minerals and Ores

Refer also to abstracts 5982 and 6354.

Radioactive Effluents

Refer also to abstracts 5699, 5976, 5980, 6004, 6016, and 6354.

5962 (PB-233430) SUMMARIES OF FOREIGN GOVERNMENT ENVIRONMENTAL REPORTS. Number 9. (Environmental Protection Agency, Washington, D. C. (USA)). May 1973 NTIS $3.00.

EPA is building a collection of environmental reports issued by foreign governments and international organizations. This is the ninth in a series of announcements of foreign documents received. The series includes summaries of government reports concerning the following: air pollution, pesticides, radiation, solid waste, water pollution, and general environmental problems. (GRA)

5963 (PTB-Ra-4) RADIONUCLIDE CONCENTRATIONS IN GROUND LEVEL AIR FROM 1971 TO 1973 IN BRUNSWICK AND TROMSOE. Kolb, W. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany)). Sep 1974. 39p. Dep. NTIS (US Sales Only) $5.00.

The activity concentrations of various fission products as well as cosmogenic and some other radionuclides contained in surface air were determined by gamma ray spectrometry and/or chemical separation. Fresh fission products were detected after each of the Chinese nuclear explosions No. 11 to 15. The cosmogenic radionuclides ^{7}Be and ^{22}Na show pronounced seasonal variations caused by stratospheric exchange in spring. By comparing the annual mean concentrations of the cosmogenic radionuclides with their production rates an excess amount of ^{35}S in the order of 50% of the total concentration was estimated for Brunswick which is assumed to be caused by a more or less continuous escape from nuclear installations or incinerators. The results for ^{32}P and ^{33}P support Hartwig's and Sittkus' conclusions that the production rate of ^{33}P after Lal and Peters should be increased by about 30%. Among the long lived natural radionuclides ^{210}Pb and ^{226}Ra were analyzed. The average activity concentration of ^{226}Ra based on 23 samples was 0.2 fCi/m^3. Its origin from industrial pollution is shown to be much more likely than whirled surface soil as a source. The systematic lower concentrations of fission products and cosmogenic radionuclides in Tromsö fit a latitude dependence curve obtained from the results of other sampling stations. Finally the results are compared with the maximum permissible concentrations recommended by ICRP. ^{210}Pb may be considered as the most critical radionuclide in this respect. (auth)

5964 (STH-3/73) STUDY ON RADIATION HAZARDS TO THE POPULATION DUE TO ACCIDENTS IN NUCLEAR POWER PLANTS AS SEEN WITH REGARD TO EMERGENCY PLANNING. Derner, H. (Bundesgesundheitsamt, Neuherberg/Muenchen (F. R. Germany). Abt. fuer Strahlenhygiene). May 1973. 37p. (In German). INIS.

11 figs.; 6 tabs.; 15 refs.

Consideration has been given to the resulting risks to the population in the neighborhood of the nuclear power plant in the case of a large reactor accident, and to the measures that can be taken for the protection of the population. In this case, it is important to know how many fission products will be released, how these spread in the environment and what effect this has on the population (external and internal irradiation). The concrete statements that can be made on emergency measures are presented. (GE)

5965 RADIATION. Chapter 6. (Committee for Environmental Conservation, London). pp 15-22 of Energy and the Environment. London; Royal Society of Arts (1974).

The subject is dealt with under the following headings: the generation of electricity from nuclear reactors (fission, radioactive isotopes); types of radiation; radiation and disease; levels of radiation (radiation doses, ICRP); radiation releases from the nuclear power program in normal operation; storage of highly active waste; dismantling of power stations; disastrous accidents; breeder reactors. The chapter concludes with a summary discussion of the possible dangers to the general public from exposure to radiation from nuclear installations and stored waste. (UK)

5966 KINETICS OF THE SELF-PURIFICATION OF A BODY OF WATER CONTAINING STRONTIUM-90 AS A RESULT OF ABSORPTION OF THE RADIONUCLIDE BY THE BOTTOM DEPOSITS. Prokhorov, V. M.; Safronova, N. G. (Agrophysical Scientific-Research Inst., Leningrad). Sov. J. Ecol. (Engl. Transl.); 4: 101-105(Jan 1974).

Translated from Ekologiya; No. 2, 12-18(1973).

The previously proposed diffusion model of the self-purification of natural water as a result of the absorption of ^{90}Sr by the bottom deposits agrees with the experimental data on the kinetics of the change in the concentration of ^{90}Sr in the water of the experimental lake. Together with the diffusion mechanism of self-purification, there operates additionally in the investigated lake a factor of self-purification that can be considered within the framework of the model. Simple computational formulas for the dependence of the concentration of ^{90}Sr in the water on the time were obtained, permitting a long-range prognosis for the experimental lake. (auth)

Radioactivity Monitoring and Transport

Refer also to abstracts 5964, 6000, 6002, 6004, 6038–6040, 6042–6044, 6352, and 7943.

5967 (BNL-19213, pp 1-2) ENVIRONMENTAL MONITORING DATA ANALYSIS AND REPORTING. Ash, J. A. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

A simple and efficient method to weed out the γ spectra of environmental samples with no detectable activity has been prepared and is in operation. The sum of the counts from channel 20 to 475 (.12 to 2.85 MeV) is taken. This is performed automatically by the analyzer. The sum is compared to a background spectra sum over the same channels. If the sample sum is less than background plus one standard deviation, the sample is assumed to have no detectable activity and no further analysis is performed. A computer program that automatically reports and graphs monthly averages of gross alpha, beta, and tritium data in environmental samples has been completed. It was used to generate some of the tables for the 1973 annual report. Checks with the 1973 records indicate that the computer results are accurate. The program has two modes of operation. The first generates the monthly averages of each sample in a form to be used for the monthly reports. The second is designed for the manual report in which the monthly history of each sample location is printed. (auth)

5968 (NIRS-RSD-39) RADIOACTIVITY SURVEY DATA IN JAPAN, NUMBER 39. (National Inst. of Radiological Sciences, Chiba (Japan)). Sep 1974. 24p. Dep. NTIS (US Sales Only) $4.25.

Radioactivity survey results of fallout by the 16th Chinese nuclear explosion test are reported. The 17th of June in 1974, The People's Republic of China carried out the 16th nuclear explosion test. Concerning this test, atmospheric disturbance was observed at the nation-wide meteorological observatories. The scale of this explosion was equivalent to 1 megaton of TNT. Fallout radioactivity measurement of this test was carried out at the nation-wide radioactivity survey stations from the 18th to the 25th of June. Meantime, comparatively high radioactivity was measured, i.e., 1603pCi/m^3 of beta radioactivity in upper air at Western Area and no especially significant levels were recorded of radioactivity iodine in milk. The radioactivity survey results of this test were considerably lower than the values in the provisional guide of radioactivity countermeasures es-

tablished by Radioactivity Countermeasures Headquarters. (auth)

5969 (ORNL-EIS-74-21(Suppl.3)) ENVIRONMENTAL ASPECTS OF THE TRANSURANICS: A SELECTED, ANNOTATED BIBLIOGRAPHY. Martin, F. M.; Sanders, C. T.; Talmage, S. S. (comps. and eds.). (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. 236p. Dep. NTIS $15.00.

This fourth published bibliography of 528 references is from the computer information file built to provide support to the Nevada Applied Ecology Group (NAEG) of the AEC Nevada Operations Office. The general scope is environmental aspects of uranium and the transuranic elements, with a preponderance of material on plutonium. In addition, there are supporting materials involving basic ecology or general reviews on other nuclides that are entered at the request of the NAEG. References provide findings-oriented abstracts. Numerical data is referred to in the comment field. Indexes are given for author, subject category, keywords, geographic location, permuted title, taxons, and publication description. (auth)

5970 (SRD-R-28) IMPORTANCE OF MONITORING GROUND CONTAMINATION AND RADIATION AFTER A REACTOR ACCIDENT RELEASE. Beattie, J. R. (UKAEA Safety and Reliability Directorate, Culcheth). 1974. 8p. Dep. NTIS (US Sales Only) $4.00.

Emergency procedures for control of potential hazards to the neighboring population from an accidental release of radioactivity from a nuclear reactor are usually designed primarily to limit the doses which could be received through inhalation and ingestion of iodine and other volatile fission products. Cesium is volatile and could be released, and when deposited on the ground it would give rise to long-term low levels of gamma radiation. The levels of gamma radiation from cesium 137/barium 137 m and what levels of other long-lived isotopes such as the transuranics which might be considered acceptable in the circumstances, and the additional monitoring which might in consequence be required for emergencies are discussed. (auth)

5971 (UCRL-51444-74) ATMOSPHERIC AND GEOPHYSICAL SCIENCES DIVISION, PHYSICS DEPARTMENT PROGRAM REPORT, FY 1974. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Oct 1974. Contract W-7405-eng-48. 19p. Dep. NTIS $4.00.

The FY 1974 research program conducted by the Atmospheric and Geophysical Sciences Division and supporting segments at Lawrence Livermore Laboratory is reviewed briefly. Unique numerical modeling capabilities in use and under development are described. Specific projects are described together with an indication of significant findings of the work. Prospects for FY 1975 include the extension of existing work and broader application of the division's capabilities. (auth)

5972 DATA. Section IV. Other Data. Radiat. Data Rep.; 15: No. 9, 609-624(Sep 1974).

Environmental radioactivity data for the year 1972 from the Feed Materials Production Center are tabulated as follows: concentrations of U, Th, gross alpha and gross beta activity in airborne particulates; concentrations of U, Th, ^{226}Ra, ^{228}Ra, dissolved alpha, and gross beta activity in water; and U concentrations in soil. The following data from the Knolls Atomic Power Laboratory are tabulated: concentrations of beta-gamma radioactivity and alpha radioactivity in Mohawk River water and municipal water during 1972; concentrations of gross alpha and gross beta-gamma activity, ^{137}Cs, and ^{90}Sr in Mohawk River bottom sediment during 1972; and concentrations of gross gamma activity and ^{60}Co in Glowegee Creek and Farmington River sediment during 1972. A list of nuclear power reactors in the United States as of June 30, 1974, is presented. Nuclear tests by the AEC at the Nevada Test Site in August, 1974, are reported. Seismic signals from Soviet underground nuclear tests were recorded. (HLW)

5973 TRANSURANIUM ELEMENTS ON LAND. Harley, J. H. (Atomic Energy Commission, New York). Trans. Amer. Nucl. Soc.; 19: 75-76(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5974 POTASSIUM, URANIUM, AND THORIUM CONTENT IN BUILDING MATERIAL OF TAIWAN. Chang, T. Y.; Cheng, W. L.; Weng, P. S. (Inst. of Nuclear Energy Research, Lung-Tan, Taiwan). Health Phys.; 27: No. 4, 385-387(Oct 1974).

The ^{238}U and ^{232}Th series and ^{K}40 in building materials contribute largely to the absorbed dose to most organs of the human body. Fifteen varieties of building material (lime, concrete brick, soil brick, soil, red brick tile (roofage), red brick, cement, sand, concrete tile (roofage) ovate stone, marble, fir wood, bamboo, rice straw, and steel (aggregate)), which represent Taiwan's buildings and houses, were investigated. The contents of potassium, uranium and thorium for each of the materials are tabulated. It is estimated that the external γ radiation from a concrete building may amount to 52 ± 4.4 mR/yr. (UK)

Atmosphere

Refer also to abstract 6001.

5975 (UCID-16039) ^{41}Ar CONCENTRATIONS AT VARYING DISTANCES FROM THE LIVERMORE POOL-TYPE REACTOR (LPTR). Kloepping, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 11 May 1972. Contract W-7405-eng-48. 17p. Dep. NTIS $4.00.

During normal operations, the Lawrence Livermore Laboratory Pool-Type Research reactor releases ^{41}Ar to the environment. Based on meteorological data and known releases from the reactor, on- and off-site ground-level concentrations of ^{41}Ar are calculated. The calibration of the effluent monitoring system by use of a 1-liter ion chamber is discussed. (auth)

5976 FRENCH DEVELOPMENTS IN THE AREA OF THE PREVENTION OF ATMOSPHERIC CONTAMINATION. Pradel, J. Energ. Nucl. (Madrid); 19: No. 88, 89-99(1974). (In Spanish).

The developments made by the French in the development of methods to prevent atmospheric contamination are discussed in a speech presented to JEN in Nov. 1972. The problem of ^{131}I and methyl iodide and the various possibilities of their retention is first considered. The various problems occurring with different types of reactors and other nuclear installations, such as processing of irradiated fuel, are compared. The problem of the different fission products, particularly the noble gases, is discussed. Some remote-control devices developed to aid in prevention of atmospheric contamination are briefly illustrated. (tr-auth)

5977 DATA. Section III. Air and Deposition. Radiat. Data Rep.; 15: No. 9, 592-608(Sep 1974).

Results are tabulated for gross beta radioactivity in surface air during April, 1974, from monitoring systems of the Environmental Radiation Ambient Monitoring System (ERAMS) and from the Air Surveillance Network of the National Environmental Research Center at Las Vegas. From gamma spectrometry results, fission products in varying combinations of ^{95}Zr, ^{103}Ru, and ^{141}Ce were identified. Results are tabulated for Canadian gross beta radioactivity in surface air and precipitation during March, 1974, from the Canadian Air and Precipitation Monitoring Program. Results are also tabulated for gross beta radioactivity in Pan American surface air during April, 1974, and in California air. Results are tabulated for concentrations of ^{234}U, ^{238}U, ^{238}Pu, and ^{239}Pu in air at various locations in the United States during July through September, 1973, from monitoring systems of the ERAMS Plutonium and Uranium in Air Component. Data collected by the Surface Air Sampling Program of the Health and Safety Laboratory during 1972 are tabulated for the following isotopes: ^{89}Sr, ^{90}Sr, ^{95}Zr, ^{137}Cs, ^{144}Ce, ^{238}Pu and ^{239}Pu. (HLW)

5978 EXPERIMENTS FOR THE DETERMINATION OF THE LOCAL ATMOSPHERIC PROPAGATION OF GASEOUS WASTES. Nester, K.; Thomas, P. (Kernforschungszentrum Karlsruhe (F. R. Germany). Abt. Strahlenschutz und Sicherheit). KFK Nachr.; 6: No. 2, 28-31(1974). (In German).

4 figs.; 6 refs.

A measuring program of the Kernforschungszentrum Karlsruhe is reported, which is expected to permit the determination of site-specific propagation parameters for different meteorological conditions, and the demonstration of local effects by a comparison with the well-known Pasquill–Gifford parameter curves. Tritiated steam was used as a tracer, which was released through the 100 m stack of the FR2 reactor. (GE)

5979 EFFECT OF PLUME RISE ON THE CRITICAL WIND SPEED DETERMINING THE MAXIMUM GROUND CONCENTRATION OF EFFLUENTS. Yeh, C. S. (Burns and Roe, Inc., Paramus, NJ). Trans. Amer. Nucl. Soc.; 19: 31-32(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5980 MONTE CARLO SIMULATION OF THE TURBULENT TRANSPORT OF AIRBORNE CONTAMINANTS. Watson, C. W.; Barr, S. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 32(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

5981 OBSERVATION OF ^{7}Be DEPOSITION. Matsunami, T.; Mizohata, A.; Mamuro, T. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 23-26(1973).

After the eleventh Chinese nuclear explosion of October 14, 1970, which is believed to have used a thermonuclear device, the activity ratio of ^{7}Be to ^{144}Ce in rainwater reached a maximum simultaneously with those of ^{141}Ce to ^{144}Ce, ^{103}Ru to ^{144}Ce, ^{106}Ru to ^{144}Ce and ^{137}Cs to ^{144}Ce. This appears to sustain that a considerable amount of ^{7}Be was produced in this thermonuclear explosion. The variation with time of monthly ^{7}Be deposition was observed by the basin method in the period from January 1970 to July 1973. From these results of observation were also calculated the yearly ^{7}Be depositions in 1970 to 1972. (auth)

Soil

Refer also to abstracts 5697 and 6783.

5982 (BARC-702) DISTRIBUTION OF NATURAL RADIOACTIVITY AND TRACE ELEMENTS IN THE SOILS AND SANDS FROM THE HIGH RADIATION COASTAL BELT OF INDIA. Kulkarni, V. V.; Pillai, T. N. V.; Ganguly, A. K. (Bhabha Atomic Research Centre, Bombay (India)). 1973. 104p. Dep. NTIS (US Sales Only) $8.25.

Experiments performed to determine the radiation dose to man from natural radioactivity present in beach sands and soils in India are described. ^{226}Ra, ^{51}Cr, ^{54}Mn, and ^{60}Co were used as tracers to study the leaching of radioactive elements in the soils and the discharge of these elements to the marine environment. (LCL)

5983 (ORNL-4979, pp 196-202) CESIUM DISTRIBUTION IN SOIL OF THE OAK RIDGE AREA. Kerr, G. D.; Abdullah, S. A.; Auxier, J. A.; Cheka, J. S.; Dickson, H. W.; Fox, W. F.; Jones, T. D.; Lupica, S. B.; Shonka, J. J.; Wilhoit, D. G. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

In order to use in-situ gamma spectrometry for the determination of concentrations of radioactivity in the soil, a model for the distribution of activity as a function of depth in the soil must be assumed. For natural emitters, one generally assumes uniform distribution in the soil. However, for fallout emitters this assumption obviously cannot be made. Studies on the actual distribution of fallout emitters in the soil show that emitters such as ^{137}Cs are distributed exponentially with depth. Since disagreement existed on the best exponential parameters to use, it was decided to make measurements of ^{137}Cs distributions in the Oak Ridge area. A soil sampling and analysis program was established which could yield information on soil density, soil moisture, and concentration of radionuclides in the soil, including, but not restricted to, ^{137}Cs. Several sites were selected in the Oak Ridge area where in-situ gamma measurements were made. An attempt was made to define the ^{137}Cs distribution in terms of an exponential function. (CH)

5984 RADIOCHEMICAL ANALYSIS OF ^{210}Pb, AS WELL AS DISTRIBUTION OF ^{210}Pb, ^{90}Sr, AND ^{137}Cs IN SOIL PROFILES, 1. Minor Elements in Terrestrial Environment. Kodaira, Kiyoshi (Sagami Chemical Research Center, Kanagawa (Japan)); Kato, Mitsuko; Ishikawa, Misako. Radioisotopes (Tokyo); 22: No. 7, 331-337(Jul 1973).

Soils were extracted with 6 N hydrochloric acid containing Pb, Cs, and Sr carriers. ^{137}Cs and ^{90}Sr were separated, and then Pb in the residual solution was separated as sulfide and radiochemically purified. After the addition of Bi carrier and the achievement of radioactive equilibrium, Bi was separated as oxychloride and submitted to radioassay. This radioactivity was identified as that of ^{210}Bi. Therefore this method was considered as a useful one for radiochemical analysis of ^{210}Pb in soil. By the application of this method, the following results were obtained: ^{210}Pb was distributed mostly within soil profiles reaching down to 15 cm. The trend of vertical distribution was almost the same also for ^{90}Sr and ^{137}Cs. ^{210}Pb content was higher in phosphate rocks than in soils. But a hypothetical pathway, along which ^{210}Pb in phosphate rocks contaminates soils as an impurity of phosphate fertilizers, was not considered to make an important contribution to the ground deposition of ^{210}Pb. (auth)

Water

Refer also to abstracts 5572 and 5573.

5985 DATA. Section II. Water. Radiat. Data Rep.; 15: No. 9, 587-591(Sep 1974).

Water quality sampling and analysis were carried out for surface, ground, and treated water by the Environmental Protection Agency and other federal and local agencies. A table is presented to show gross beta and alpha and tritium concentrations at various sampling locations in California, Nevada, and Utah during April and June, 1974. (HLW)

5986 TRANSURANIC ELEMENTS IN MARINE ENVIRONMENTS. Bowen, V. T. (Woods Hole Oceanographic Inst., MA). Trans. Amer. Nucl. Soc.; 19: 76(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Ecosystems and Food Cycles

Refer also to abstracts 5986, 6354, 6356, 8043, and 8065.

5987 (BNWL-1867) ECOLOGICAL BEHAVIOR OF PLUTONIUM AND AMERICIUM IN A FRESHWATER ECOSYSTEM. Phase I. Limnological Characterization and Isotopic Distribution. Emery, R. M.; Klopfer, D. C.; Weimer, W. C. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1974. Contract AT(45-1)-1830. 82p. Dep. NTIS $7.25.

A Pu processing waste pond on the Hanford Reservation was studied since July 1973 to characterize the pond's limnology and determine the ecological distribution of Pu and Am in this ecosystem. This shallow 14-acre pond has existed and received Pu processing wastes for about 30 years, having a possible total Pu input of 8.1 kg. Limnological studies have characterized the pond as having a simple food web existing under ultra-eutrophic conditions, with physical circulation and mixing being primarily controlled by wind and secondarily by heated water entering the pond. This pond receives about 10 m^3 of water per minute, of which at least 95 percent leaves via percolation through the desert-like soil. Macrophytes (mainly Potamogeton), algae (mainly Cladophora), benthic invertebrates (mainly dipteran and odonate larvae, hemipterans, amphipods, and gastropods) and goldfish are the major biotic components of this system. Sediments are the principal repository of Pu and Am, containing about 390 pCi of $^{238,239,240}Pu$ (ΣPu)/g (dry) and about 83 pCi of ^{241}Am/g (dry) with ratios of ^{238}Pu: $^{239,240}Pu$ of about 1 : 1, and ^{241}Am : ΣPu of about 0.23 : 1. Levels of these transuranics in the pond water are much lower having concentrations of ΣPu of about 0.01 pCi/l and ^{241}Am of about 1.1 pCi/l, with ratios of ^{238}Pu : $^{239,240}Pu$ of about 3.5 : 1 and ^{241}Am : ΣPu of about 120 : 1. In the biota the principal concentrator of Pu and Am is decomposing algal material (designated as algal floc, and rich in microorganisms) with levels of ΣPu of about 2 nCi/g (dry) and ^{241}Am of about 250 pCi/g (dry). This material serves as a major energy source for most of the pond fauna. In spite of the relatively high levels present in the sediments and major food source most of the biota have accumulated relatively lower levels of Pu and Am. Only an ephmeral growth of watercress (Rorippa) exceeds both ΣPu and ^{241}Am levels in the sediments. However watercress, dragonfly larvae (Libellula), and the snail Lymnaea had higher ^{241}Am concentrations than that of the sediments. Levels of these transuranics in other aquatic flora and fauna are also reported which range from 0.5 to 154 pCi of ΣPu/g and 0.3 to 50 pCi of ^{241}Am/g. Ratios of ^{238}Pu : $^{239,240}Pu$ in biota were generally higher than that of the sediments (i.e. > 1 : 1), but lower than that of pond water (i.e. < 3.5 : 1). The same was true for ratios of ^{241}Am : ΣPu in biota as most organisms had ratios exceeding 0.23 : 1 (with a maximum of 2 : 1), but not approaching that of pond water (120 : 1). Also discussed are concentration factors for pond biota with respect to various expressions of biological availability. Depending upon assumptions made for availability the CF values for any organism may range by many orders of magnitude. (auth)

5988 SIGNIFICANCE OF STABLE IODINE-127 IN MILK. Kelleher, W. J.; Prins, H. R. (Dept. of Environmental Conservation, Albany, NY). Radiat. Data Rep.; 15: No. 9, 567-573(Sep 1974).

The unexpected high concentrations of stable iodine in milk found when studying the specific activity concept for iodine-129 around a nuclear fuels reprocessing plant led to an evaluation of the use of iodine-129 to iodine ratio in milk samples to calculate population doses. In order to use specific activity to calculate thyroid dose, it will be necessary to establish values for the concentration of iodine in thyroids. If a constant concentration of iodine in the thyroid is assumed and there is a high enough concentration of iodine in the milk to be able to assume that milk is the only source of iodine in the thyroid, a relationship between thyroid dose and iodine-129 to iodine or iodine-131 to iodine ratios can be developed. The use of specific activity in milk to determine dose will have the greatest application in evaluating the man-rem dose from the discharges of iodine-129 from fuel processing plants. (auth)

5989 DATA. Section I. Milk and Food. Radiat. Data Rep.; 15: No. 9, 575-586(Sep 1974).

Routine surveys of radioactivity in milk were conducted at various sampling locations in the western hemisphere during April, 1974. The most abundant fission products in milk were ^{89}Sr,

^{90}Sr, ^{131}I, ^{137}Cs, ^{140}Ba, and ^{40}K. Stable Ca and K were used for assessing the biological behavior of similar radionuclides. Results are tabulated. Accuracy of data was determined in order to combine data from international, national, and state networks. Current data are discussed in relation to monthly averages for 1974. (HLW)

5990 RADIOACTIVE IODINE IN THE ENVIRONMENT. Il'in, L. A.; Arkhangel'skaya, G. V.; Konstantinov, Yu. O.; Likhtarev, I. A. pp 7-57 of Radioactive Iodine in the Problem of Radiation Safety. Moscow; Atomizdat (1972). (In Russian).

15 figs.; 17 tables; 111 refs.

The significant situations accompanying the release of radioactive isotopes of iodine into the environment were examined. The data from studies on the distribution of ^{131}I between the gaseous phase and aerosols and the identification of compounds consisting of penetrating fractions of iodine, apparently the basic source for the introduction of ^{131}I into the human organism from the biosphere, were analyzed. The chemical mechanisms of radioiodine were examined. Data, characterizing the irradiation of thyroid gland with ^{131}I in people living in regions of high radiation burdens because of accidents or nuclear tests, were reported. Questions on the migration of radioiodine in the biosphere along different links of the biological chain up to man were discussed. A quantitative evaluation was made of the concentration of ^{131}I in food and air. (tr-auth)

5991 ^{60}Co AND ^{137}Cs IN MYTILUS EDULIS OF ADRIATIC AND TYRRHENIAN SEAS AND AN ESTIMATE OF CONCENTRATION FACTORS. De Franceschi, L.; Gentili, A.; Gremigni, G.; Guidi, P. (Centro Applicazioni Militari Energia Nucleare, S. Piero a Grado, Italy). Health Phys.; 27: No. 4, 400-402(Oct 1974).

The ^{60}Co and ^{137}Cs contents of the mollusc Mytilus edulis, collected off the Italian coasts, have been determined for the years 1962 to 1971. Details of measurement methods are given. The minimum detectable activity for ^{60}Co was 1 pCi while that for ^{137}Cs was about 2 pCi. Sample weights ranged from a few grams up to 20g. The activities per gram in Mytilus of ^{60}Co were less than the limits of sensitivity of the apparatus. With regard to ^{137}Cs, activities were mostly below the minimum detectable level though in a few cases the activity was observable. (UK)

Radiometric Techniques

Refer also to abstracts 5549, 5588, 5589, 5978, 5982, 5983, 6059, 6150, 6198, 6769, and 6942.

5992 (AD-782587) PHOSPHORITE DEPOSITS FROM THE SEA FLOOR OFF PERU AND CHILE: RADIOCHEMICAL AND GEOCHEMICAL INVESTIGATIONS CONCERNING THEIR ORIGIN. Burnett, W. C. (Hawaii Univ., Honolulu (USA). Hawaii Inst. of Geophysics). May 1974. Contract N00014-70-A-0016-0001. 178p. (HIG-74-3). NTIS $5.50.

Thesis.

Sedimentary phosphorites sampled from the sea floor off the coasts of Peru and Chile were investigated to establish their ages and mode of formation. Results of uranium-series dating suggest that phosphate deposition was episodic rather than continuous during the late pleistocene. Radiometric ages correlate well with periods of high eustatic stands of the sea. Bulk chemical and mineralogical compositions of the phosphate rocks were determined by instrumental techniques. Microanalysis, with an electron probe microanalyzer and a scanning electron microscope suggests that the apatite was authigenic and had formed as direct chemical precipitate rather than by replacement. A model of phosphorite formation is proposed that involves inorganic precipitation of apatite within anoxic pore waters and subsequent concentration of the apatite by physical processes. The concentration of apatite into indurated phosphate rocks is brought about by winnowing and reworking processes, possibly in response to a change in the sedimentary environment caused by eustatic sea-level fluctuations or tectonic movements. (GRA)

5993 (COO-3405-2) APPLICATIONS OF SPONTANEOUS FISSION OF ^{238}U IN THE STUDY OF NATURAL CRYSTALS AND GLASSES. Final Report. (Pennsylvania Univ., Philadelphia (USA). Dept. of Geology). 23 Jun 1972. Contract AT(30-1)-3969. 18p. Dep. NTIS $4.00.

The fission track studies of geological and man made materials were concerned primarily with the calibration of experimental parameters and with the redetermination of the decay constant of ^{238}U for spontaneous fission. This study investigated whether the presence of dissolved ions in solutions occurring in nature may repair crystal defects by either reacting directly with the crystal or stimulating recrystallization. When an ionic solution is present in contact with crystal surfaces, annealing of fission tracks may be expected to occur at lower temperatures. Depending on the type of solution interaction with the crystal, the phenomenon of track fading can be confined to the surface or may penetrate into the crystal. Apatite crystals separated from granite were annealed at 550°C for 6 h to remove spontaneous fission tracks, and were then irradiated to induce fission of ^{235}U. The crystals were then placed in an epoxy mount and polished to reveal an internal surface. These mounts were placed in NaCl solutions of 0.5, 1, 2, 4N for times up to 10^5 min and temperatures of 84 and 97°C. Standard etching conditions of 50 sec in 5% HNO_3, 23°C were used. Ninety percent reduction of track density was observed after 10^5 min in a 4N solution. For prolonged or repeated etching, not only are the annealed tracks exposed to the etching solution for a longer time, but the surface layer is also removed. This explains why repeated etching results in an increase of the track density toward the original track density. During the 70-day experiment, annealing was not confined to the surface, but progressed into the crystal for a distance exceeding 2 μm. If this rate of advance of the annealing front into the crystals is confirmed by experiments over a longer time, the decrease of the annealing temperature under hydrothermal conditions may be of some importance for proper interpretation of fission-track ages. It also demonstrates that natural surfaces, not only external crystal faces but also those with good cleavage, should be avoided for fission-track dating. Comparison of fission-track annealing characteristics in minerals, in the presence of solutions of different compositions, may provide information about the mechanisms of the track annealing process, especially when an ion common to both crystal and solution is present. (auth)

5994 (ORNL-4979, pp 202-207) MEASUREMENTS OF RADON DAUGHTER CONCENTRATIONS IN AIR. Kerr, G. D.; Abdullah, S. A.; Auxier, J. A.; Cheka, J. S.; Dickson, H. W.; Fox, W. F.; Jones, T. D.; Lupica, S. B.; Shonka, J. J.; Wilhoit, D. G. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

An alpha-particle spectrometer was used in measurements of the effects of sealants on the emanation of radon from concrete. Radon daughter levels were measured in nine structures in Grand Junction, Colorado, at the request of the AEC. Tailings from uranium mines had been used in their construction, but two had been reconstructed to remove most of the tailings. Because most of the tailings had been used as a fill, the measurements were made in either the basements of the structures or the first floor of slab-type structures. With one exception, the measurements were made in the living areas of the houses. Examples of the radon daughter measurements in one of the structures are included. (CH)

5995 MEASUREMENT OF NATURAL ^{14}C CONCENTRATIONS IN THE ORGANIC MATTER SOILS. Intermediary Summarising Report. Scharpenseel, H. W. Z. Pflanzenernaehr. Bodenk.; 133: No. 3, 241-263(1972). (In German).

12 figs.; 3 tabs.; 33 refs.

Radiocarbon dating of soil based on charcoal in autochthonous position produces the true age (TA) of soil formation; humus-C in recent profiles reveals the apparent mean residence time (AMRT), buried humus-C in fossil soils shows the AMRT of the sample-C till the event of burial plus the time lapsed since then. Among a greater number of natural radiocarbon measurements on soil samples, all profiles from Spodosols, Udalfs, Udolls, Plaggepts, and Vertisols are subjected to correlation analysis with regard to the AMRT profile depth interdependence. Comparison of methods, used for pretreatment of soil samples prior to benzene synthesis and C^{14} counting procedure, motivates the use of the method. Only the clay-humus is decanted from a soil suspension and its carbon is enriched by a centrifugal method. Measurements of the AMRT of the humus-C in soils within the rooted zone, and comparison with C^{14} dates of the same soil material, but under enough cover to be outside the rooted zone, further with estimates by other dating procedures, give a first hint regarding the extent of rejuvenation of some carbon samples, derived from recent soil profiles within the rooted zone. More parallel measurements on humus-C and charcoal-C originating from the same soil horizons, are of key importance for adequate information about the extent of rejuvenation in recent soils. Besides limited potentialities in pedochronology, natural radiocarbon measurements find a domaine in pedogenetic and soil systematic, further humus-kinetic questions. Their value for soil organic matter transformation and carbon cycle studies is evident. Some examples are presented. (auth)

5996 IZOTOPNAYA KOSMOKHIMIYA. (Isotope Cosmochemistry). Sobotovich, E. V. Moscow; Atomizdat (1974). 208p.

Problems arising in the area of the new science, isotope cosmochemistry, are discussed. These problems consist partially of the primary questions on the universe, on the origin and evolution of

the substance of the universe and particularly of our solar system. These problems were solved on the basis of a study of the dispersion of elements and isotopes in different cosmic objects such as the earth and moon, meteorites and tectites, the sun, and stars. The formation of elements, the forces maintaining the combustion of the stars, and the energy sources shaping the face of our planet are examined. A significant part is devoted to the history of the earth and its formation and development. (tr-auth)

5997 THE RESULTS OF THE WORK ON DEVELOPING AND PUTTING IN OPERATION THE RADIATION TECHNOLOGY METHODS AND FACILITIES. Srapenyants, R. A. pp 178-182 of Isotope and Nuclear Radiation Application in Agriculture. Section 2. Isotope Application in Crop Science and Agriculture. Moscow; Atomizdat (1971). (In Russian).

From all-union scientific-technical conference "20 years of production and isotope and nuclear radiation application in national economy of the USSR"; Minsk, USSR (7 Oct 1968).

Results of work for use of radioisotopes and nuclear radiation in agricultural sciences and production are presented. Further development was carried out on methods for routine rapid analyses of soils, plants, roots, and fertilizers using automatic neutron activation analysis. Work was done on the application of radiation techniques in automation and mechanization of the most difficult production processes for fertilizer and the time-consuming production processes of harvest and post-harvest development of processing of root and tuber crops. In the designing of new, efficient methods and radiation apparatus for study and control of different technological parameters of agricultural production, isotopes and nuclear radiation were used successfully. (tr-INIS)

5998 THE EXPERIMENT ON TRITIUM APPLICATION IN SOIL-HYDROLOGICAL INVESTIGATIONS. Lenskij, L. A. pp 167-170 of Isotope and Nuclear Radiation Application in Agriculture. Section 2. Isotope Application in Crop Science and Agriculture. Moscow; Atomizdat (1971). (In Russian).

From all-union scientific-technical conference "20 years of production and isotope and nuclear radiation application in national economy of the USSR"; Minsk, USSR (7 Oct 1968). 16 refs.

The radiometry of tritium and the use of tritium in agricultural studies are analyzed. In the reaction of tritium and soil water, the tritium is more concentrated in free water than in the bound water and in the solid phase of the soil. In the reaction of soil samples with tritium-labeled water, because of hydrogen isotope exchange there is isotopic dilution of the tritium. Formulas were derived for calculating the concentration of isotopic-exchange hydrogen of soils from the results of studies on isotopic exchange sorption of tritium by soils from aqueous solutions under static and dynamic conditions. Filtration of tritium-labeled water in soils was used to evaluate the transfer cross-section and the distribution ratio, which were determined by the porosity and the concentration of exchange hydrogen in the dispersed medium. (tr-INIS)

5999 INFLUENCE OF HUMIDITY AND POROSITY OF CHROMIUM ORES ON THE INTENSITY OF GAMMA-RADIATION ABSORPTION. Malakhov, G. M.; Sotskij, A. R.; Azaryan, A. A. (Krivorozhskij Gornorudnyj Inst. (Ukrainian SSR)). Isotopy SSSR; No. 30, 15-16(1973). (In Russian).

The weak effect on the absorption of γ radiation of humidity (0.8 to 5.0 wt %) and porosity (1.7 to 16) of Cr ore deposits was established. These data are necessary during the determination of the parameters of radiometric apparatus designed for automatic sorting of Cr ores. (tr-auth)

Site Surveys

6000 (BNL-19213) HEALTH PHYSICS AND SAFETY DIVISION ANNUAL PROGRESS REPORT, JANUARY 1-DECEMBER 31, 1973. (Brookhaven National Lab., Upton, N. Y. (USA)). 1 Aug 1974. 49p. Dep. NTIS $5.50.

Separate abstracts were prepared for 14 sections of this report. (CH)

For abstracts of individual sections see: 5967, 6001, 6002, 6018, 6019, 6084-6086, 6291, 6321, 7449, 7943, 7971, and 7972.

6001 (BNL-19213, pp 12-16) SKYSHINE: ANNUAL SITE BOUNDARY NEUTRON DOSE EQUIVALENT. Distenfeld, C. H.; Klemish, J. R. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1-December 31, 1973.

Data presented on the neutron dose equivalent at the BNL site boundary show 0.66 mrem/yr during 1973. Methods used for background reduction in the monitoring system are discussed. (CH)

6002 (BNL-19213, pp 31-36) 1973 ENVIRONMENTAL MONITORING REPORT SUMMARY. Hull, A. P. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1-December 31, 1973.

The amount of radioactivity and other environmental pollutants in airborne and liquid effluents, and the natural background and radiation levels in the vicinity of Brookhaven National Laboratory attributable to its operations during 1973 are summarized. Among the data reported are facility releases, external radiation levels; air particulate, tritium and radioiodine concentrations; precipitation and liquid effluent-related concentrations in stream, ground water and surveillance wells, as well as in milk, grass, and soil samples. External radiation levels at the north boundary of the Laboratory, attributable to an ecology forest γ irradiation source, were 15.5 mrem/yr, or 3.1% of the applicable radiation protection standard. Other than tritium, there was no indication of BNL effluents in environmental air and precipitation samples. In air, the largest average BNL effluent related tritium concentration at the site boundary was 1.3×10^{-11} μCi/cm^3, which is <0.01% of the applicable radiation concentration guide (RCG). In precipitation it was 5.30×10^{-7} μCi/ml, which is 0.02% of the RCG for drinking water. (auth)

6003 (DOCKET-701432-8) WESTINGHOUSE RECYCLE FUELS PLANT. License Application, Environmental Report, Supplement 2. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). 2 Oct 1974. 5p. Dep. NTIS $4.00.

Four questions on surface and ground water conditions in the Savannah River basin are answered, as supplemental information required for the Westinghouse Recycle Fuels Plant environmental report. (LCL)

6004 NUCLEAR POWER PLANT IN AGDENES. Evaluation of Various Consequences. Andersen, S.; Boehren, O.; Egaas, E.; Furu, N.; Jenseg, S. L.; Naess, P. H.; Urdahl, T. E. Trondheim, Norway; Trondheim Univ. (1974). 81p. (In Norwegian).

An attempt is made to present some factors which, according to the authors' opinion should be evaluated before commencing a nuclear power plant. Following an elementary description of the nature of a nuclear power plant, a fairly thorough analysis is made of the social and economic consequences which the construction and operation can have for the Agdenes community. Thereafter the radiation hazards in air and water, both during normal operation and following an accident, are considered, as well as the thermal pollution in the sea. Finally an attempt is made to place an Agdenes plant in a wider perspective. A series of possible consequences are shown, whose evaluation is necessarily subjectively dependent on one's scale of values and social objectives. No attempt was made to present a conclusion. (NO)

6005 PREPARATION OF AN ENVIRONMENTAL REPORT AS A GRADUATE CLASS PROJECT. Ringle, J. C.; Bossi, R. H. (Oregon State Univ., Corvallis). Trans. Amer. Nucl. Soc.; 19: 26(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Thermal Effluents

Refer also to abstracts 6203, 6249, and 7733.

6006 (ANL-8060(Pt. 4), pp 1-7) FIELD STUDIES AT THE DRESDEN COOLING POND: AN INTRODUCTION. Hicks, B. B.; Wesely, M. L.; Hart, R. L. 1973.

In Radiological and Environmental Research Division annual report, January-December 1973.

A micrometeorological research program is being conducted at the site of the Dresden nuclear power plant cooling pond to assess the problems of measuring and predicting the rate of heat transfer from cooling ponds to the atmosphere. The pond site, volumetric flow rate through the system, the waste heat dissipation rate the experimental techniques used to measure heat and moisture fluxes from the surface; and current field operations are described. (LCL)

6007 (ANL-8060(Pt. 4), pp 8-25) LOW-LEVEL BULK AERODYNAMIC MEASUREMENTS OVER A COOLING POND. Hicks, B. B. 1973.

In Radiological and Environmental Research Division annual report, January-December 1973.

The bulk aerodynamic method for determining the rate of heat exchange to the atmosphere from surface waters, specifically a cooling pond in this study, involves calculating the sensible and latent heat fluxes from measured values of air density, water surface temperature, wind speed at various heights above water surface, air temperature, and specific humidity. The contribution of measurement errors, particularly errors due to the use of immersed thermometers for measuring surface temperatures

and to the use of air data measured at a reference height of 4 m above the water surface as water surface air data, is discussed. Recommendations are made for refining the measuring methods and minimizing errors in the bulk aerodynamic method. (LCL)

6008 (ANL-8060(Pt. 4), pp 26-41) LINE-AVERAGE THERMAL EXCHANGES MEASURED ABOVE A COOLING POND USING AN OPTICAL TECHNIQUE. Wesely, M. L. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

The calculations necessary to determine from optical measurements the sensible and latent heat fluxes above artificially heated water surfaces are summarized. The refractive index of the atmosphere above the heated water is measured optically and can be interpreted in terms of the magnitude of the heat fluxes. The optical method is described, and experimental procedures required for making the human judgements on which the field measurements rely are thoroughly explained. (LCL)

6009 (ANL-8060(Pt. 4), pp 42-54) DEPENDENCE OF BULK TRANSFER COEFFICIENTS UPON PREVAILING METEOROLOGICAL CONDITIONS. Hicks, B. B. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

An attempt is made to verify some recent results in studies of the surface sensible and latent heat transfers to the atmosphere from heated surface waters. These results allow the bulk transfer coefficients for heat transfer to be parameterized in terms of wind speed and atmospheric stability, using data obtained in stable conditions over Lake Michigan during October 1973. (LCL)

6010 (COM-73-11350) WATER QUALITY MODELING. A Bibliography with Abstracts. Report for 1964–May 1973. Lehmann, E. J. (National Technical Information Service, Springfield, Va. (USA)). Jul 1973. 112p. (NTIS-WIN-73-006). NTIS $20.00.

The NTISEARCH bibliography contains 107 selected abstracts of research reports retrieved using the NTIS on-line search system. The abstracts contain information on models used to describe the chemical, physical, biological, or hydrological conditions of oceans, estuaries, lakes, rivers, runoff, or ground water. (auth)

6011 (COM-74-10938) WATER QUALITY MODELING. A Bibliography with Abstracts. Report for 1964–April 1974. Lehmann, E. J. (National Technical Information Service, Springfield, Va. (USA)). May 1974. 163p. (NTIS-WIN-74-036). NTIS $20.00.

The bibliography contains 158 selected abstracts of research reports retrieved using the NTIS on-line search system NTISEARCH. The abstracts contain information on models used to describe water quality. This covers models of the chemical, physical, biological, and hydrological processes important to water quality. Included are studies on the modeling of eutrophication, nutrient removal, pollutant dispersion, stream flow, heat dissipation, limnological factors, and storm water runoff. (GRA)

6012 (PB-211275) OCEANOGRAPHY OF THE NEARSHORE COASTAL WATERS OF THE PACIFIC NORTHWEST RELATING TO POSSIBLE POLLUTION. Volume I. (Oregon State Univ., Corvallis (USA). Dept. of Oceanography). Jul 1971. 629p. (W-72-12190-VOL-1). GPO $5.25.

To answer the environmental questions posed by use of the nearshore area for industrial outfalls, a coastal pollution group was formed to collect, organize, and analyze all oceanographic data which would aid in the evaluation of sites for industrial outfalls on the open coast of the Pacific Northwest. Part I of the report presents a discussion of the physical and geological factors which are known for the region of study. Part II summarizes the knowledge of the chemistry and radiochemistry of the region, and part III considers the biological aspects with emphasis on temperature relations and attempts to establish some preliminary priorities. Part IV is an attempt to describe the coastal ecosystem by integrating the physical, chemical, geological, and biological information into a general overview. A bibliography with over 3100 references is given. (GRA)

6013 (TID-26670) CONSIDERATIONS ON THE EFFECTS OF HIGH TEMPERATURES ON ALGAE AND FISHES. A Literature Review. (Academy of Natural Sciences of Philadelphia, Pa. (USA). Dept. of Limnology). May 1954. 85p. Dep. NTIS $7.25.

For Savannah River Plant, Aiken, SC.

It is apparent from this review of the literature that prolonged and uniform heating of a body of water to 33° to 35°C would be deleterious to the fish and algae characteristic of southern temperature rivers such as the Savannah. However, if certain areas of the river could be maintained below this temperature the fishes could retreat to such areas provided the oxygen content and other environmental characteristics were suitable. Likewise, if certain regions in shallow water could be maintained with temperatures of 30°C or lower a diversified algal flora would survive in such areas. (~250 references) (auth)

Chemical Effluents

Refer also to abstracts 5560 and 6365.

6014 (ANL/ES-CEN-1007) REDUCTION OF ATMOSPHERIC POLLUTION BY THE APPLICATION OF FLUIDIZED-BED COMBUSTION AND REGENERATION OF SULFUR-CONTAINING ADDITIVES. Annual Report, July 1973–June 1974. Vogel, G. J.; Swift, W. M.; Lenc, J. F.; Cunningham, P. T.; Wilson, W. I.; Panek, A. F.; Teats, F. G.; Jonke, A. A. (Argonne National Lab., Ill. (USA)). Sep 1974. Contract W-31-109-eng-38. 134p. (EPA-650/2-74-104). Dep. NTIS $5.45.

The Argonne National Laboratory (ANL) program for developing and demonstrating the feasibility of fluidized-bed combustion for possible use in power and steam-plant applications is divided into three studies: (a) the combustion of coal in a pressurized combustor; (b) a determination of the distribution of trace elements in the combustion products; and (c) a fundamental investigation of the kinetics of additive sulfation and regeneration reactions. A bench-scale, fluidized-bed combustion pilot plant capable of operating at 10-atm pressure was used to evaluate the effects of operating variables on response variables such as SO_2 and NO levels in the flue gas, combustion efficiency, additive utilization, and heat-transfer coefficients. High retentions of sulfur (>90%) and low NO levels (<150 ppm) were achieved. The combustor was also successfully tested using a variety of coals: a highly caking, high-volatile bituminous coal, a high ash subbituminous coal, and a low-heating-value lignite. Data, in the form of material balances, are reported for the four trace elements of primary concern: Hg, Pb, Be, and F. Also reported are data on Na concentrations in the particulate matter entrained in the flue gas from the combustor. The kinetics of the reaction of half-calcined dolomite with SO_2 were studied at atmospheric pressure by thermogravimetric analysis. The reaction was found to be first order with respect to the SO_2 concentration in the presence of H_2O vapor and approximately three-fourths order in the absence of H_2O vapor. (auth)

6015 (CEA-CONF-2617) METHOD FOR THE DETERMINATION OF THE TRANSPORT CHARACTERISTICS OF POLLUTING MATERIALS IN UNDERGROUND WATERS. Corompt, P.; Gaillard, B.; Guizerix, J.; Margrita, R.; Molinari, J.; Corda, R.; Crampon, N.; Olivier, D. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Chimie Appliquee). Feb 1974. 28p. (In French). (CONF-740312-3; SM-182/41). Dep. NTIS (US Sales Only) $4.50.

From symposium on isotope techniques in groundwater hydrology; Vienna, Austria (11 Mar 1974).

A method was used in which the pulse responses of a chemical tracer of the water was obtained between two boreholes and used to define the minimum transfer time of polluting materials. The linearity conditions of the system, the characteristics of the terrain sampling between two boreholes, signals received in one borehole, and transverse dispersion are analyzed in detail. Some practical examples, drawn from current studies, are given. (tr-auth)

6016 (PB-230935) NEWS OF ENVIRONMENTAL RESEARCH IN CINCINNATI, MAY–DECEMBER 1973. (National Environmental Research Center, Cincinnati, Ohio (USA)). Apr 1974. 62p. (EPA-670/9-74-002). NTIS $6.25.

A series of reports are included on the following subjects: consumerism and solid wastes; constraints to spreading sewage sludge on cropland; CAM-1: using enzymes to detect insecticides; plastics and incineration; using porous pavement to control runoff; relating socio-economic variables to technology for environmental management; oil identification; state of the art; the EPA-DC pilot plant for water pollution control; monitoring radionuclides in reactor effluents; using reclaimed rubber tires in road dressings; conserving water at home; removing organic matter from drinking water; and catalytic converters used in health effects studies. (GRA)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstract 6256.

General Detectors and Monitors

Refer also to abstracts 5983, 5994, 6391, 6392, 6394, 6412–6414, 7439, and 7698.

6017 (AD-780432) ABSOLUTE CALIBRATION OF X-RAY IONIZATION CHAMBERS. Meekins, J. F.; Unzicker, A. E.; Dere, K. P.; Kreplin, R. W. (Naval Research Lab., Washington, D. C. (USA)). 8 May 1974. 21p. (NRL-7698). NTIS $3.00.

A method was devised to determine the response of ionization chambers to x radiation by direct measurement. The method was applied to several ionization chambers of the Solrad type. Resulting responses differed from those predicted. The standard of measurement employed was a proportional counter, which is described. (auth)

6018 (BNL-19213, pp 5) DIGITAL ENVIRONMENTAL MONITOR. Chester, J. D. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

The Digital Environmental Monitor (DEM), which has been in the development stage for the past year, continued to undergo tests for stability and minimum detectable levels. The instrument was designed to measure dose rates from 1 μR/h to 10 mR/h. Reevaluation to determine if it could be made to measure lower dose rates is described. (WHK)

6019 (BNL-19213, pp 37-38) RADIOLOGICAL PHYSICS AND CHEMISTRY OF LIQUID SCINTILLATORS. Levin, E. M.; Baum, J. W. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1 – December 31, 1973.

Research on quenched liquid scintillator systems excited by alpha and beta particles is outlined. (WHK)

6020 (CEA-CONF-2694) CONDUCTION CALORIMETRY. Application to Radionuclides. Ganivet, M.; Lepoivre, A.; Patin, C.; Patin, H. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 – Saint-Paul-les-Durance (France); Aix-Marseille-1 Univ., 13-Marseille (France)). 1974. 9p. (In French). (CONF-740565-1). Dep. NTIS (US Sales Only) $4.00.

From French meeting of calorimetry and analysis; Rennes, France (9 May 1974).

A large-size calorimeter for the determination of the Pu content of nuclear fuels was previously described. The present study reports on some of the properties of this calorimeter. In the permanent regime the experimental and theoretical thermal study confirms the a priori calculations made on construction materials of fuels for the response of the detector and the possibility of extrapolating to macrocalorimeters. The study of the establishment in the permanent regime time makes it possible to position the experimental measurements with respect to the infinite time state. The calibration of the calorimeter by heat-active materials and by the Joule effect is described. (JSR)

6021 (PB-233969) ANALYSIS OF THE DESIGN, CHARACTERISTICS, AND APPLICATION OF IN VIVO DETECTORS IN NUCLEAR MEDICINE. Friedland, S. S.; Vasudevan, R.; Kashef, B. (University of Southern California, Los Angeles (USA). Dept. of Electrical Engineering). Jul 1973. Contract AT(04-3)-113. 31p. (RB-73-29). NTIS $4.75.

A family of in-vivo nuclear semiconductor detectors and in-vivo amplifiers have been developed for biomedical applications and their characteristics analyzed. The instruments have proved to be rugged, to operate at low potentials (20 volts) and to maintain their characteristics over long periods of time. Additional analysis and experimental data are required to be able to fully exploit their potentialities as a clinical and research tool. (GRA)

6022 (PB-778034) APPLICATIONS OF SOLID-STATE X-RAY DETECTORS IN DIFFRACTION TECHNIQUES. Final Report, 1 July 1972–31 December 1973. Leonard, L. (Franklin Inst. Research Labs., Philadelphia, Pa. (USA)). 31 Jul 1973. Contract N00014-73-C-0018. 30p. (FIRL-F-C-3454). NTIS $3.25.

A Si(Li) solid state x-ray detector has been evaluated for its potential application in x-ray residual stress and retained austenite measurements. For fixed angle diffraction of low 2 theta values the inherent errors in determining peak positions coupled with the limited resolution of the detector made it impossible to achieve the degree of accuracy characteristic of the standard high 2 theta scanning technique for measuring residual stresses. However, there may be particular repetitive applications where the ability to measure stresses to plus or minus 10,000 psi in a few minutes time may warrant the use of the solid state detector. A technique was developed for measuring retained austenite by means of analyzing the intensities of four diffraction lines, two from austenite and two from martensite, recorded simultaneously at a fixed low 2 theta angle. For a standard specimen with 4% austenite the reproducibility was plus or minus 0.3% for counting times as low as 3 to 5 minutes. Since the solid state detector can also be used for fluorescent and structural analyses it can increase the versatility of a standard diffractometer. (auth)

6023 (SGAE-2321) HIGH PRECISION MEASUREMENT OF A FORWARD-BACKWARD ASYMMETRY IN $\beta-\gamma$ DIRECTIONAL CORRELATIONS. Dydak, F.; Polaschegg, H. D.; Riehs, P.; Serentschy, G.; Weinzierl, P. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.). Sep 1974. 11p. (CONF-740920-15; PH-163/74). Dep. NTIS (US Sales Only) $4.00.

From 2nd international symposium on nuclear capture gamma-ray spectroscopy; Petten, Netherlands (2 Sep 1974).

An apparatus for the measurement of extremely small A_1 coefficients in $\beta-\gamma$ directional correlations is described. The advantages of a multiple detector arrangement, the mechanical precision requirements and the source preparation are discussed as well as a new technique for the evaluation of the data. (auth)

6024 EFFECT OF THE SPECIFIC RESISTANCE OF P-SILICON ON THE ELECTROPHYSICAL CHARACTERISTICS OF THE SENSITIVE REGION OF Si(Li)p-i-n-DETECTORS. Azimov, S. A.; Muminov, R. A.; Yafasov, A. Ya. (Physical-Technical Inst., Tashkent). Dokl. Akad. Nauk Uzb. SSR; No. 5, 20-22(1974). (In Russian).

The effect of the specific resistance of p-silicon on the specific resistance and homogeneity of distribution of electric field is investigated. The dislocation density in all samples was $10^4/cm^2$; the oxygen content was less than $10^{16}/cm^3$. The electric field distribution was most homogeneous in the region of initial specific resistance ρ_{Si} >700 ohm-cm, but < 3000 ohm-cm. On increasing the specific resistance of the initial silicon the inhomogeneity in the distribution of electric field increases by a factor of ~2.0. (SJR)

6025 GAMMA CAMERA: PRESENT STATUS AND FORESEEABLE EVOLUTION OF THESE INSTRUMENTS. Allemand, R.; Gariod, R. (CEN, Grenoble, France). pp 287-294 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French)

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

Gamma cameras can be classified according to their mode of detection and for each of these detection modes by the type of collimator used. The different collimation systems for several γ cameras are described. The relative merits of ionization detectors, scintillation detectors, and semiconductor detectors are compared. (JSR)

6026 RECENT ADVANCES IN XENON-FILLED MULTIWIRE PROPORTIONAL CHAMBERS. Kaufman, L. (Univ. of California, San Francisco). Trans. Amer. Nucl. Soc.; 19: 40 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6027 RECENT ADVANCES AND APPLICATIONS IN POSITRON INSTRUMENTATION. Brownell, G. L.; Burnham, C. A.; Hoop, B. Jr. (Massachusetts General Hospital, Boston). Trans. Amer. Nucl. Soc.; 19: 40-41(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6028 RECENT ADVANCES IN 3-D IMAGING IN NUCLEAR MEDICINE. Budinger, T. F. (Univ. of California, Berkeley). Trans. Amer. Nucl. Soc.; 19: 41-42(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6029 RESPONSE STABILITY OF THE ORTHOGONAL STRIP GERMANIUM GAMMA CAMERA. Detko, J. F. (Sloan-Kettering Inst., New York). Trans. Amer. Nucl. Soc.; 19: 42-43(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6030 GROOVELESS HIGH-PURITY GERMANIUM GAMMA-RAY CAMERA WITH DELAY-LINE READOUTS. Armantrout, G. (Univ. of California, Livermore); Camp, D.; McQuaid, J.; Galwey, R.; Okubo, D.; Kaufman, L.; Hattner, R.; Price, D.; Swann, S. (Univ. of California, San Francisco). Trans. Amer. Nucl. Soc.; 19: 45(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6031 DIGITAL X-RADIOGRAPHY FOR MEASURING SMALL DENSITY VARIATIONS. Kaplan, S. N.; Ortendahl, D.; Perez-Mendez, V.; Shiraishi, L.; Valentine, K. (Univ. of California, Berkeley). Trans. Amer. Nucl. Soc.; 19: 45-46(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6032 COMPARISON OF THREE DETECTOR SYSTEMS FOR LOCALIZATION OF BONE ABSCESSES. Garcia, D. A. (VA Hospital, West Roxbury, MA); Entine, G. Trans. Amer. Nucl. Soc.; 19: 48-49(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6033 TOWARD OPTIMIZATION OF IMAGING EQUIPMENT FOR THYROID DIAGNOSIS. Corey, K. R. Trans. Amer. Nucl. Soc.; 19: 58-59(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6034 DIRECTIONS IN MEDICAL RADIATION INSTRUMENTATION. Wood, R. W. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 60(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6035 MEDICAL INSTRUMENTATION RESEARCH: NATIONAL SCIENCE FOUNDATION RESEARCH APPLICATIONS DIRECTORATE. Devey, G. B. (National Science Foundation, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 60-61(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6036 PULSE-HEIGHT EFFECTS IN THE MEASUREMENT OF ^{233}U FISSION CROSS SECTIONS. Felvinci, J. P.; Melkonian, E. (Columbia Univ., New York). Trans. Amer. Nucl. Soc.; 19: 420(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6037 FRAGMENT ENERGY-DEPENDENT BIASES IN IONIZATION CHAMBER MEASUREMENTS OF FISSION CROSS SECTIONS. Cohensedgh, F.; Felvinci, J. P.; Melkonian, E. (Columbia Univ., New York). Trans. Amer. Nucl. Soc.; 19: 420-421 (1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6038 INTRODUCTORY REMARKS. Murphy, T. D. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 448(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6039 IN-PLANT RADIATION MONITORING. Barney, H. (General Atomic Inc., San Diego, CA). Trans. Amer. Nucl. Soc.; 19: 448(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6040 DESIGN CONSIDERATION FOR RADIATION MONITORING OF NUCLEAR POWER PLANT RELEASE PATHS. Willems, V. H. (Gilbert Associates, Inc., Reading, PA). Trans. Amer. Nucl. Soc.; 19: 448(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6041 PROBLEMS WITH PROCESS MONITORING SYSTEMS. Lewis, L. (Duke Power Co., Charlotte, NC). Trans. Amer. Nucl. Soc.; 19: 448-449(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6042 DISCUSSION OF AVAILABLE RADIATION MONITORING INSTRUMENTATION. Schuh, D. III. (Nuclear Measurements Corp., Indianapolis). Trans. Amer. Nucl. Soc.; 19: 449(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6043 IN-PLANT RADIATION MONITORING SYSTEMS. Ingeneri, S. (Stone and Webster Engineering Corp., Boston). Trans. Amer. Nucl. Soc.; 19: 449(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6044 AREA RADIATION MONITORING. Buchanan, H. (Yankee Atomic Electric Co., Westborough, MA). Trans. Amer. Nucl. Soc.; 19: 449(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6045 DEVELOPMENT OF COMPOUND SOLID STATE DETECTOR. Suzuki, E. (Rikkyo Univ., Tokyo). Uchusen Kenkyu; 17: No. 4, 575-586(Feb 1973). (In Japanese).
The surface barrier type GaAs detectors, which have the advantages of high band gap energy, large atomic number and hence capability of sufficiently long term observation at normal temperature, were produced for trial, and tested on various characteristics at normal temperature. The results are as follows: (1) liquid mixture of 52 cc 1.03 N NaOH and 3 cc H_2O_2(26%) was most preferable for etching. Sn alloy contact seems to provide the best ohmic contact as electrodes so far. (2) Reverse current was 1 μA or so up to -70 V; (3) noise increases gradually with applied voltage, and begins to increase rapidly after about -60 V is reached; (4) experimental value of capacitance is 5 times as large as theoretical value; and (5) FWHM of pulse height characteristic for the α particles of 5.15 MeV was 560 keV for one of the detectors, and 820 keV for another one. From the results, prevention of contamination during manufacturing process and growing crystals of large area and volume by the epitaxial method may be significant problems in the future. (JA)

6046 SCINTITOMOGRAPHY IN NUCLEAR MEDICINE. Arimizu, N. (National Inst. of Radiological Sciences, Chiba, Japan). Radioisotopes (Tokyo); 23: No. 5, 303-311(May 1974). (In Japanese).
The method and present status of scinti-tomography are reviewed. There are two principles in scinti-tomography; selective measurement type and vignette type. The vignette type, which was practically more useful, was further divided into the method with scanner and that with scintillation camera according to the apparatus used. Data processing of scinti-tomography with computer, positron scinti-tomogram, boundary area between x-ray tomography and scinti-tomography and problems of scinti-tomography are mentioned. (JA)

6047 SIGNAL PROCESSING IN NUCLEAR MEDICINE. Papoulis, A. (Polytechnic Inst., Brooklyn). J. Franklin Inst.; 296: No. 6, 433-442(Dec 1973).
The volume distribution of a radioisotope is determined in terms of the output of a scintigraphic camera scanning a plane. It is shown that the time of observation required to estimate the density of the received photons within specified errors is minimum if the motion of the camera is adaptively controlled. The investigation involves the estimation of the average density of a non-uniform Poisson process. (auth)

6048 DEVELOPMENT OF A SUPERCONDUCTING THIN-FILM LOW-ENERGY PARTICLE DETECTOR. Hoyle, J. A. Charlottesville, VA; Univ. of Virginia (1974). 140p. University Microfilms Order No. 74-23,254.
Thesis (Ph. D.).
Techniques for constructing a superconducting thin-film particle detector have been developed. Detecting surfaces were fabricated by evaporating a 500 Å tin-indium film on a glass cover slide and scratching to obtain a 1 micron wide strip. By controlling the temperature (±.001°K) of the film at a point just below the critical temperature and operating at current densities near the critical current density, pulses due to single incident Ar, Ar^+, He, and He^+ particles were observed. Pulses were observed for helium and argon down to 200 eV and 150 eV respectively and up to approximately 800 eV. The response of the detector to ions and neutral particles was determined to be identical. Efficiency estimates range from 5% to near 100% depending on the region of the film considered sensitive. Calculated values for the size of normal regions of the film due to incident particles were of the same order of magnitude as those measured. It was observed after allowing argon to condense on the superconducting surface, that the detector became insensitive. Pulse height analysis indicated

no dependence of pulse height on incident particle energy. It was concluded that this lack of pulse height dependence on incident energy was due to an intrinsic fluctuation phenomenon of the superconducting film. (Diss. Abstr. Int., B)

6049 GAMMA RAY IMAGE FORMATION BY STOCHASTIC TIME MODULATION. May, R. S. Ann Arbor, MI; Univ of Michigan (1974). 241p. University Microfilms Order No. 74-25,265.
Thesis (Ph. D.).

The spatial distribution of radioactive fluid concentration can be measured indirectly by observing the emerging gamma rays. A method is proposed for imaging of gamma rays, and its feasibility is shown by analysis and computer simulation. The approach involves insertion of a succession of coded apertures between the gamma emitting region and the detection systems. The apertures can be generated randomly or chosen as a mutually orthogonal set. A sequence of unintelligible coded images are measured and recorded. The original spatial distribution can be reconstructed by digital cross correlation of the coded images and fluctuations in the coding functions. (WHK)

6050 NUCLEAR RADIATION DETECTOR MADE OF SEMI-INSULATING GALLIUM ARSENIDE. Bukki, S. M.; Muminov, R. A.; Shebiot, U. V. (Physical-Technical Inst., Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 4, 74-75(1974). (In Russian).

To improve the energy and time resolution, studies were carried out on semiconductor radiation detectors of gallium arsenide having a specific resistance of 10^7 ohm-cm, a sensitive region thickness of 100 to 200 μm and a sensitive surface area of 0.75 cm^2. The volt-ampere characteristics were determined. The current increased almost linearly with increasing voltage, and remained constant with a change in bias. Because of significant carrier mobility in gallium arsenide it is possible to obtain detectors with a high time resolution. In the experimental samples the rise time of the signal was less than 5 nsec which can be associated with the small thickness of the sensitive region on the one hand, and with the high carrier mobility in gallium arsenide on the other hand. (SJR)

6051 MULTIWIRE PROPORTIONAL CHAMBER AS AN AREA DETECTOR FOR PROTEIN CRYSTALLOGRAPHY. Cork, C. (Univ. of California, San Diego, La Jolla); Fehr, D.; Hamlin, R.; Vernon, W.; Xuong, N. H.; Perez-Mendez, V. J. Appl. Crystallogr.; 7: No. 3, 319-323(1 Jun 1974).

A multiwire proportional chamber (30 × 30 cm) together with its electronic readout into a large core memory (mass core) has been used successfully as a digital area detector for protein crystallography. The diffraction pattern stored in the mass core can be displayed on a TV monitor. An IBM 1800 computer has fast random access to the mass core and is used on line to estimate the integrated reflection intensities. To characterize this new area detector, the geometric linearity, the resolution and the quantum detection uniformity have been measured. Preliminary results show that with this new system one can collect intensity data from protein crystals about an order of magnitude faster than with the standard diffractometer. (auth)

6052 INTRODUCTION TO LIQUID SCINTILLATION COUNTING. Dyer, A. London; Heyden and Son Ltd. (1974). 119p.

The book is intended as an introduction to liquid scintillation counting for scientists and technicians with some knowledge of radiochemical technique. It will also serve as a source book for some more experienced practitioners and as a text-book for courses in radiochemistry, the medical use of radioisotopes, radiobiological assay and health physics at the undergraduate or post-graduate level. It does not attempt to provide answers to all the problems encountered in sample preparation for liquid scintillation counting. Each problem is often specific to the user who should be able to choose the correct general method, and an accurate reference, from the information given in the relevant chapters. An index is included. (auth)

6053 GAS OR VAPOR SCINTILLATION COUNTER. Shigematsu, A. Japanese Patent 1973,10436. 26 Mar 1968. 4p. (In Japanese).

A gas or vapor scintillation counter is given, which can enjoy efficiency of more than 10% for soft β-ray and which extracts only a limited portion from a sample for inspecting purposes. In this scintillation counter, a liquid scintillator is added to the liquid/gas sample containing radioactive material, and is mechanically uniformalized by being exposed to ultrasonic waves. The liquid or gas sample thus uniformalized is vaporized through a nozzle with the aid of a pressure of a carrier gas, or is gasified by heating. On the other hand, a scintillator liquid without radioactivity is likewise vaporized or gasified, and is admixed with the vaporized or gasified sample in a chamber. The resultant mixture is introduced into a transparent detector cell. The obtained fluorescence due to the radioactivity is measured by two photomultipliers. (JA)

6054 PRESENT STATUS OF THE DEVELOPMENT AND PROBLEMS IN Ge(Li) GAMMA-RAY DETECTORS. Sakai, E. (Japan Atomic Energy Research Inst., Tokai). pp 1-14 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

The present status of the development and problems in Ge(Li) gamma-ray detectors are reviewed. The items presented are the material, the energy resolution, pulse risetime, gamma-ray detection efficiency, temperature dependence and the radiation damage of Ge(Li) detectors. Recent progress since 1968 in the abovementioned items is mainly described. The progress before 1967 was described in a previous review-paper (E. Sakai: Oyobutsuri, 30, 2–19 (1968) in Japanese). (auth)

6055 RADIATION DETECTING DEVICE. Miyazawa, T. (to Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1973,6513. 29 Jun 1968. 3p. (In Japanese).

A radiation detecting system is provided for detecting two-dimensional distribution of radiation and for representing it in digital manner. The detector comprises a first electrode which is formed of metal plate and a second wire electrode which is disposed spirally or corrugatedly on an electrically insulating plane parallel to the first electrode. A high voltage is applied to the first electrode through a quenching element. The second wire electrode is electrically resistive, the resistence per unit length being substantially uniform. The second electrode is grounded at one end and is connected to a pulse height analyzer at other end, from which pulse is generated whose multitude is proportional to the distance between the grounded end and a position at which ionizing event occurs. The pulse is fed to a pulse-height to position converter through a pulse height analyzer. Thus two-dimensional distribution of the incident position and frequency of radiation are indicated in a digital manner. (JA)

6056 DEPENDENCE OF CHANNEL ELECTRON MULTIPLIER EFFICIENCY ON THE NATURE OF THE INTERACTION BETWEEN VARIOUS RADIATIONS AND THE SUBSTANCE OF EMITTER. Smirnova, L. P.; Shyutte, N. M. (AN SSSR, Moscow: Inst. Kosmicheskikh Issledovanij). Dokl. Akad. Nauk SSSR; 214: No. 3, 549-552(21 Jan 1974). (In Russian).

Data are presented on the absolute efficiency of channel electron multipliers, and the efficiency is compared for electrons, protons, and ultraviolet radiation. Measurements were made for the three types of radiation with the same intensities, the particle energy selected being 5 keV. The dependence of the absolute efficiency on the feed potential for the three types of radiation and the effect of different factors on this absolute efficiency were determined. The efficiency was found to depend on the radiation conversion coefficient on the emitting wall surface. The absolute efficiency of recording of the radiation was determined by the energy spectrum of the electrons emitted from the irradiated surface, and the absolute recording efficiency increased with increase in the relative number of high-energy electrons emitted. (tr-auth)

6057 DESIGN AND DEVELOPMENT OF A DETECTOR TO MEASURE INTEGRATED RADON CONCENTRATIONS. Costa-Ribeiro, C. A. D. New York; New York Univ. (1974). 170p. University Microfilms Order No. 74-21,542.
Thesis (Ph. D.).

A new radon detector was designed, developed, and tested. The instrument is capable of integrating radon concentrations from 30 to 550 pCi/l of air for long exposures (168 h). For shorter exposures (5 h) the detector will respond to concentrations ranging from 800 to 14,200 pCi/l. The instrument was designed both for personnel monitoring of uranium miners and for surveillance of areas where radon concentrations in the atmosphere constitutes a possible health hazard. The design of the instrument includes rapid and inexpensive readout of exposures while providing means for keeping permanent exposure records. The portable detector is a passive integrating device, rugged enough to stand the harsh conditions existing in underground mines, such as high temperature and humidity. The system is based on passive diffusion of radon gas, but not of its daughter products, through a filter. Upon diffusion the decay of radon in the active volume of the detector produces positively charged ^{218}Po ions, which are electrostatically collected onto a thin aluminized mylar cathode. The alpha particles emitted from the cathode surface, through the decay of ^{218}Po and ^{214}Po irradiate a cellulose nitrate foil. After etching of this foil, alpha tracks became visible and are counted through a simple optical system. By means of convenient calibration the cumulative radon exposure is determined. Three prototypes were constructed and calibrated in the laboratory. Results show that

although the overall efficiency of the present design is low (0.7%), the instrument is dose-rate independent and capable of monitoring radon concentrations encountered in underground US uranium mines. All basic parameters involved in the design and operation of the instrument are extensively discussed, both theoretically and experimentally. (Diss. Abstr. Int., B)

6058 SOME CHARACTERISTICS OF PROPORTIONAL COUNTERS FOR THE MEASUREMENT OF LOW ACTIVITIES OF ^{3}H AND ^{14}C. Szarka, J.; Usacev, S.; Povinec, P. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Natur. Univ. Comenianae, Phys.; 13: 117-129(1973). (In Slovak).

The experimental setup for the determination of low-level activities of ^{3}H and ^{14}C and the preparation of the gaseous filling of the proportional chambers are described. The behavior of the counter with methane or ethane filling gas with up to 70% H_2 was determined and the results are given graphically. (JSR)

6059 DATING WITH PROPORTIONAL COUNTERS. Chrapan, J.; Oravec, J.; Sitar, B.; Usacev, S.; Durcek, K.; Schmidt, Z.; Vaskovska, E. (Komenskeho Univ., Bratislava). Acta Fac. Rerum Natur. Univ. Comenianae, Phys.; 13: 145-166(1973). (In Slovak).

The use of proportional counters for dating is discussed from the viewpoint of the background radiation, the duration of the measurement, and the efficiency of the measurement setup. The techniques used for the measurement of low activities with a proportional counter are outlined. The electrical properties of the working gas are measured. Dating with the radiocarbon method is discussed. (JSR)

6060 MEASUREMENT OF LIFE TIME OF NUCLEAR LEVEL. II. Sakata, A. (Himeji Inst. of Tech., Japan). Himeji Kogyo Daigaku Kenkyu Hokoku; No. 26A, 9-13(Oct 1973). (In Japanese).

A time-to-amplitude converter, based on the start-stop principle, is described. Appreciable improvements have been obtained compared to the author's previous apparatus. The intrinsic resolution (fwhm) is less than 20 ps with a mercury pulser. The physical resolutions of 0.84 ns and 2.1 ns are found in the prompt gamma rays of ^{22}Na using Naton 136 plastic scintillators and NaI (Tl) scintillators respectively. Photomultipliers are XP 1020 and 56AVP. The time calibration constants are in good agreement in the different cases. The linearity is within ~ 1%. The TAC unit presents good stability against the varying external temperatures. (auth)

6061 ENERGY DEPENDENCE OF SOLID STATE TRACK DETECTORS AS FAST NEUTRON DOSIMETERS; IRRADIATION BY Am–Be, Am–F SOURCES, AND BY 14 MeV NEUTRONS. Spurny, F.; Lochmanova, J. (Lab. for Radiological Dosimetry, Prague). Jad. Energ.; 20: No. 9, 306-310(Sep 1974). (In Czech).

Theoretical sensitivities of polymer foils to neutrons from Am–F and Am–Be sources and to fast neutrons of fission spectrum are calculated. Theoretical sensitivities are compared with experimental data, obtained from the irradiation by Am–F and Am–Be sources, and by 14 MeV neutrons. Makrofol E, etched by water solution of KOH and C_2H_5OH, and cellulose acetobutyrate, etched by solution B, both at 70°C, have been used as solid state track detectors. It is shown that experimental sensitivities increase with the decrease of half thickness h of foils; this influence is more remarkable for higher neutron energies. For h ~ 20 μm, the values of sensitivities for Am–Be source and 14 MeV neutrons are about 10^4 tracks .cm^{-2} .rad^{-1} and 10^3 tracks .cm^{-2} .rem^{-1}. In the case of Am–F source, the sensitivities are lower. It can be inferred from this fact, that used polymer foils are, for mentioned conditions of chemical etching, roughly energetically independent for neutrons with the energies higher than ~ 1.3 to 1.4 MeV. Comparison of theoretical and experimental sensitivities shows, that in these foils, recoils are detected if their energy is ≥ 0.2 MeV. (auth)

6062 DETERMINATION OF THE NEUTRON EMISSION RATE OF A NEUTRON SOURCE BY THE MANGANESE-SULPHATE BATH METHOD. Kralik, M. (Lab. for Radiological Dosimetry, Prague). Jad. Energ.; 20: No. 9, 311-314(Sep 1974). (In Czech).

The manganese-sulphate bath method, considered to be a primary method for determination of the neutron emission rate of radioactive neutron sources, is discussed. The neutron emission rate of Ra-alfa-Be source has been measured with an accuracy of better than 1%. (auth)

6063 MEASUREMENT OF SCINTILLATION DECAY CURVES IN THE NANOSECOND REGION. Onishi, Masayoshi (Nagasaki Univ. (Japan)); Niki, Eiji. Jap. Anal.; 22: No. 9, 1126-1135(Sep 1973). (In Japanese).

An apparatus for the measurement of scintillations using the sampling oscilloscope SAS 500 was set up. Čerenkov radiation was observed and the ability of the apparatus was studied with this instrumental impulse response. Crystal scintillations of trans-stilbene, anthracene, and NaI; Tl were observed. Linear energy transfer (L.E.T.) effect of crystal scintillation of trans-stilbene was found, when irradiated by α and β rays. When irradiated by β-ray, the ratio of intensity of fast component to that of slow component was larger than that by α-ray and the lifetimes of fast and slow components were smaller than those by α-ray. The initial spike originated from the two exiton annihilation was observed when anthracene crystal was irradiated by α-ray. Decay curves of liquid scintillation from the scintillator (toluene +2, 5-diphenyloxazole (PPO) 4 g/l) were observed and the lifetimes of two components etc. were obtained. The lifetimes of the photo-fluorescences by ultraviolet excitation were measured with FL 10 type phase fluorometer based on the phase shift method. From them, the following results were studied. (1) Photo-fluorescent lifetimes of PPO solutions are smaller than the lifetimes of the liquid scintillation. Considerable processes besides the fluorescence process of PPO molecules exist in the case of liquid scintillation. (2) When the concentration of PPO is 4 g/l, reemissions of the fluorescence result from the absorption of the fluorescence or scintillation. The lifetimes become a little larger apparently. (3) L.E.T. effect of the liquid scintillation exists also as well as that one of trans-stilbene crystal. Different decay curves of liquid scintillation are delivered whether α or β-ray radiates the scintillator. Then there is a good possibility of the pulse shape discrimination using the liquid scintillation, resolving time of which is smaller than that one of trans-stilbene. (4) The influence of dissolved oxygen on the intensity and decay curves is studied, and the decrease of intensity of slow component which is larger than that of fast component is pointed out. (5) The influence of wavelength shifter 1,4-bis[2-(5-phenyloxazolyl)] benzene (POPOP) on the intensity and decay curves is tested. Then from the facts that the decay curve does not change hardly etc., the importance of the non-radiative energy transfer from PPO molecules to POPOP molecules is pointed out. (auth)

6064 RELATIONSHIP OF A CHARGED-PARTICLE METER'S DEAD TIME TO THE COUNTING RATE. Ryzhinskii, M. V. Meas. Tech. (USSR) (Engl. Transl.); 17: No. 4, 607-608(Apr 1974).

Translated from Izmer. Tekh.; 17: No. 4, 76-77(Apr 1974).

It is noted that a Geiger-Mueller counter's dead time, i.e., the time during which the counter does not record particles entering its volume, depends on the rate of counting pulses. It has been shown that the dead time decreases with a rising counting rate. However, in applying corrections for the dead time in the majority of cases this fact is not taken into consideration and that time is considered to be constant. It is attempted to find out to what extent variations in the dead time affect the value of corrections applied in measuring the counting rate of particles in high intensity preparations. (WHK)

6065 ELECTRONIC CIRCUIT FOR SELECTION OF ALPHA AND BETA PARTICLES, USING MONOLITHIC COMPARATOR AND LOGIC IC'S. Kazubek, M.; Modzelewski, A. (Instytut Radioelektroniki Politechniki, Warsaw). Nukleonika; 19: No. 9, 803-809 (1974). (In Polish).

The pulse shape discriminator to separation pulses from beta and alpha particles employing the zero crossing method is described. As a zero crossing detector, a fast monolithic comparator is used. For logic selection of pulses TTL integrated circuits are used. Some typical results are presented. (auth)

6066 IMPROVEMENTS IN/OR RELATING TO THERMOLUMINESCENT IMAGES. Broadhead, P.; Newman, G. A. (To Kodak Ltd.). British Patent 1,354,149. 22 May 1974. 3p.

In the system described an electrically insulating substrate is employed, carrying a metal layer and a thermoluminescent layer, these two layers being in contact. After exposure to radiation an electric current is passed through the metal layer so as to heat it uniformly and cause uniform heating of the thermoluminescent layer. An advantage is that the system can be used with large area thermoluminescent panels and the formation of hot spots is avoided. Examples of application are given. (UK)

6067 Si(Li) SEMICONDUCTOR DETECTOR IN ANGLE AND ENERGY DISPERSIVE X RAY DIFFRACTOMETRY. Laine, E.; Laehteenmaeki, I.; Haemaelaeinen, M. (Turku Univ., Finland). J. Phys., E (London); 7: No. 11, 951-954(Nov 1974).

An x-ray diffractometer system is described with which angle dispersive, energy dispersive, and combined angle and energy dispersive diffraction measurements can be carried out. The appropriateness and the advantages of these methods under different experimental conditions are discussed. The preliminary measurements have shown promising results in using other than characteristic wavelengths in angle dispersive x-ray diffractom-

etry. A combined angle and energy dispersive method is realized experimentally. (auth)

6068 DETECTION OF LOW ENERGY POSITRONS USING SPIRALED ELECTRON MULTIPLIERS. Pendyala, S.; McGowan, J. W.; Orth, P. H. R.; Zitzewitz, P. W. (Univ. of Western Ontario, London). Rev. Sci. Instrum.; 45: No. 11, 1347-1348(Nov 1974).

The positron detection efficiency of a Spiraltron is determined using a conventional two-gamma coincidence detection system as a reference. Under the experimental conditions described in this note, the efficiency of the Spiraltron is found to be nearly 90%, as compared to an ~2% efficiency of the two-gamma system employed in our laboratory. (auth)

6069 12-INPUT MAJORITY COINCIDENCE CIRCUIT WITH DIGITAL TAKEOFF. Basiladze, S. G.; Man'yakov, P. K.; Parfenov, A. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 722-725 (1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 86-89(1974).

A fast 12-input majority coincidence circuit with digital takeoff of events having a multiplicity ranging from 1 to 4 is described. The circuit has a gating forbid input and is implemented using integrated circuits with emitter coupling. (auth)

6070 MONITORING THE BEAM OF PULSED NEUTRON SOURCES. Deme, Sh.; Ir, K. E. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 671-672(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 42-44(1974).

The principle of monitoring the intensity and spectral distribution of neutrons in beams from a pulsed reactor is described. The operation of the monitoring system is based on recording tritons from the ^{6}Li (n, α) T reaction and α particles from a controlled plutonium source by means of a silicon detector. The controlled plutonium source provides the possibility of continuously monitoring or stabilizing the monitor path. (auth)

6071 PROPORTIONAL COUNTERS FOR A MEASUREMENT OF SMALL QUANTITIES OF ^{14}C. Ivliev, A. I.; Alekseev, V. A. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 688-689 (1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 56-57(1974).

The construction of a proportional counter for measurement of small quantities of ^{14}C($\simeq 10^{-12}$ Ci) is considered. The characteristics of a counter having a volume of 25 cm^3 were determined for various filler gases: CO_2, C_2H_2, and $CO_2 + C_3H_8$. (auth)

6072 PLUNGER CHAMBER FOR MEASURING THE LIFETIMES OF EXCITED STATES OF NUCLEI. Ivanov, M. A.; Lemberg, I. Kh.; Mishin, A. S. (Physical-Technical Inst., Leningrad). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 684-687(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 53-56(1974).

In order to determine the lifetime of excited nuclear states a plunger chamber has been designed and fabricated. The plunger is attached onto the goniometer, which allows it to be oriented parallel to the target. The movement of the plunger along the beam axis is accomplished by means of a micrometer. The procedure for determining the distance between the plunger and the target is described, as well as the procedure for setting them parallel to each other. (auth)

6073 QUADDED CHANNEL BASED ON INTEGRATED CIRCUITS FOR PROPORTIONAL CHAMBERS. Basiladze, S. G. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 737-739(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 99-101(1974).

A quadded channel designed for proportional chambers is described, which is implemented using integrated circuits (i.c.) with emitter coupling. The circuit is designed for amplifying, shaping, delaying, and memorizing signals, and likewise for starting the electronic circuitry from "fast OR" and "OR with memory" signals. The minimum actuation threshold is 0.4 mV and the time resolution is 10 nsec. (auth)

6074 MULTIWIRE LARGE-CAPACITY CORONA-SPARK COUNTER. Usacev, S.; Oravec, J.; Holy, K. (Komenskeho Univerzita, Bratislava, Czechoslovakia). Acta Fac. Rerum. Natur. Univ. Comenianae, Phys.; No. 14, 113-126(1973). (In Slovak).

A new, large-capacity corona-spark counter of the plane-parallel type for measuring extremely low alpha-particle activity is described. It is shown that it is possible to construct a multiwire corona-spark counter of plane-parallel type which is insensitive to weakly ionizing radiation but has good properties with respect to alpha-particle radiation. The proposed counter has an operating-characteristic plateau at a measured discrimination level ranging from 600 to 2000 V. Its efficiency is 95% for an uncollimated source, and its background is practically equal to zero. These properties, together with the possibility of placing a large quantity of the sample in the sensitive space, makes this counter highly suitable for measuring low-activity alpha-active samples. (IAA)

6075 CHOOSING THE GAS FILLER OF A CORONA-SPARK COUNTER: GAS MIXTURES. Oravec, J.; Benovic, D. Acta Fac. Rerum Natur. Univ. Comenianae, Phys.; No. 14, 105-111(1973). (In Slovak).

A demonstration of the advantages of gas mixtures as the working filler of a corona-spark counter is described. The most advantageous gas mixtures for this purpose are found to be binary Ar-Ne mixtures, which have an advantageous ratio of alpha particle amplitude to corona amplitude, an operating characteristic with a long plateau (of the order of kilovolts), and a gas amplification coefficient ranging from 1000 to 10,000. (IAA)

6076 GAS SCINTILLATION DETECTOR FOR SOFT X RADIATION. Baron, S. Kh.; Verkhovskii, B. I.; Sotnikov, V. A. (All-Union Scientific-Research and Design Inst., Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 693-695(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 60-62(1974).

The construction and results of investigating detectors of soft x radiation which are based on a xenon scintillator whose luminescence yield is increased by a nonself-maintaining gas discharge are described. The investigations were carried out in the energy range from 6 to 10.5 keV. (auth)

6077 EFFECT OF AN INITIATOR ON THE STABILITY OF THE SCINTILLATION PROPERTIES OF PLASTIC SCINTILLATORS. Glutvina, I. G.; Zhil'tsova, L. Ya.; Matveeva, E. N.; Rubina, O. G.; Stoletova, I. M.; Shafranov, M. D. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 696-698(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 63-65(1974).

Properties of plastic scintillators (p.s.) obtained by the method of initiated polymerization in the presence of benzoyl peroxide were studied. It was shown that the initiator improves the stability of the scintillation and optical characteristics of plastic scintillators. The use of benzoyl peroxide in amounts of up to 0.1% by weight is recommended for obtaining plastic scintillators that operate reliably. (auth)

6078 QUENCH CORRECTION IN LIQUID SCINTILLATION COUNTING. Kulberg, G. H.; Deinert, R. H. (to Nuclear-Chicago Corp.). South African Patent 225,234. 8 Feb 1973. Priority date 10 Feb 1972, USA. 22p.

A method for determining counting efficiency using a liquid scintillation radiation detecting and counting apparatus having pulse amplitude accumulative means for pulses generated by photodetecting means as a result of scintillations caused by radioactive events in a liquid sample containing a known radioactive source is described. The method comprises passing the aforesaid pulses to said pulse amplitude accumulative means to produce a cumulative integral sum of pulse amplitudes, counting the number of pulses contributing to the cumulative integral sum of pulse amplitudes, dividing the integral sum of pulse amplitudes by the number of pulses to ascertain an average pulse amplitude, and determining the average pulse collection efficiency as a function of average pulse amplitude. (INIS)

6079 CONCENTRATION FEATURES OF THE KINETICS OF RADIATION LUMINESCENCE OF CsI-Tl AND NaI-Tl. Gulakov, I. R.; Pertsev, A. N. Zh. Prikl. Spektrosk.; 21: No. 2, 345-346 (Aug 1974). (In Russian).

Using a statistical single-photon method, measurements were made of the time characteristics of the build-up fronts and the scintillation count curves for NaI(Tl) (alpha and gamma activation) and CsI(Tl) (gamma activation) in the activator luminescence field with activator variation of three or four orders of magnitude. The values for the time constants obtained do not explain the dependence on the activator concentration. (tr-auth)

6080 SPECIAL CONSTRUCTION FEATURES OF SPECTRAL EQUIPMENT FOR COSMIC STUDIES. Buznikov, A. A.; Lakhtanov, G. A. Zh. Prikl. Spektrosk.; 21: No. 2, 372-380(Aug 1974). (In Russian).

The special construction features of spectral equipment for cosmic studies are examined. These features are required because of both the effect of cosmic space factors and the conditions for fixing on cosmic objects. Information is presented on the special

construction features of movable junctions of housing parts and of attachments of optical elements. Problems are considered related to the action of the surrounding medium on the optical parts and electronic units and measures for increasing the reliability of their operation. Means for increasing the precision and sensitivity of measurements in the infrared region of the spectrum are considered. (tr-auth)

6081 DEVICES FOR SENSING RADIATION. Burke, H. K.; Michon, G. J. (to General Electric Co.). US Patent 3,836,773. 17 Sep 1974. Filed Date 30 Apr 1973. 12p.

In an array of radiation sensitive devices each including a pair of closely coupled conductor-insulator-semiconductor cells on a common substrate of one conductivity type, stored charge is repeatedly transferred from one cell of the pair to the other cell of the pair before being injected into the substrate and an electrical signal developed thereby. In order to minimize charge loss to the substrate and noise ultimately produced in the electrical signal due to the repeatedly incomplete transfer of charge between the cells of a pair, a region of opposite conductivity type is provided in the substrate substantially surrounding the semiconductor portions of the capacitor cells and contiguous therewith. (10 Claims, 10 Drawing Figures) (Official Gazette)

6082 MINICOMPUTER ENHANCEMENT OF GAMMA CAMERA IMAGES. Sebern, M. J. Milwaukee; Marquette Univ. (1974). 96p. University Microfilms Order No. 74-22,303. Thesis (Ph. D.).

The gamma camera, as an instrument for obtaining radioisotope images, is one of the prime tools available in the application of nuclear medicine, at least at the present state of the art. The routine use of gamma camera images as a diagnostic resource to the clinician and researcher is widespread. Nevertheless, these images often leave much to be desired in such areas as resolution, clarity, and clinical utility. This is particularly true in the use of liver scans, where one researcher has estimated a diagnostic reliability of fifty percent. The current research has as its object the exploration of image enhancement methods appropriate to the problem area, which are at the same time compatible with the rather extreme constraints of minicomputer-based processing systems. The operational system described in this study processes gamma camera images in the frequency domain in less than ten minutes on a minicomputer with only 8192 words of memory. This is made possible by special spatial pre-processing, a two-dimensional Fast Fourier Transform program, and a careful consideration of the physical interpretation of the two-dimensional Fourier transform. This physical interpretation, while perhaps not new, is a key factor in the success of this system in the light of previous failures. Both phantom and clinical patient studies bear out a significant degree of enhancement in the images processed by this system. (Diss. Abstr. Int., B)

Radiation Dosimeters

Refer also to abstracts 6000, 6229, 6276, 6800, 6938, 7418, and 7943.

6083 (AD-781476) RADIATION FROM THE MICOM FLASH X-RAY UNIT AND DETECTION BY THERMOLUMINESCENCE TECHNIQUES. Holder, J. D.; Buchman, W. G. (Army Missile Command, Redstone Arsenal, Ala. (USA)). 25 Apr 1974. 35p. (RG-74-15). NTIS $3.25.

The purpose of the report is to compile relevant radiation dosimetry material relating to the Febetron 705 flash x-ray and to introduce the uninitiated to the area of thermoluminescence radiation dosimetry. (auth)

6084 (BNL-19213, pp 7-12) PERSONNEL NEUTRON MONITORING BADGE DEVELOPMENT. Distenfeld, C. H.; Klemish, J. R. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

The Brookhaven Neutron Dosimeter employing TLD and thorium damage track detectors is described. The preliminary field evaluation is described, and the high energy damage track response is discussed. (WHK)

6085 (BNL-19213, pp 17-18) ENVIRONMENTAL MONITORING TLD STUDIES. Gilmartin, J. T. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

The Environmental Monitoring TLD field study which began on May 31, 1972, was continued throughout 1973 with some slight modifications. Only one type of phosphor is currently being used: a CaF:Dy type 200, ¼ in by ¼ in by 0.035 in. Fading of CaF:Dy phosphors at elevated temperatures was tested and results are given. (WHK)

6086 (BNL-19213, pp 47-48) NTA PROTON RECOIL TRACK FADING IN PERSONNEL NEUTRON DOSIMETRY. Phillips, L. F. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

Two Kodak NTA proton track fading studies were performed using two different types of sealing packets and storage at 100% relative humidity (R. H.). Results are presented. (WHK)

6087 (COO-3243-3, pp 24-45) INTERNATIONAL NEUTRON DOSIMETRY INTERCOMPARISON. Goodman, L. J.; Colvett, R. D. 1 Jul 1974.

In annual report on research project.

Measurements were made for an International Neutron Dosimetry Intercomparison (INDI) at the Radiological Research Accelerator Facility by fourteen scientists, eight from outside the USA, and the results were reported to the committee. The kerma and absorbed dose measurements using ionization chambers and a precision long counter and the monitoring measurements made during kerma and absorbed dose measurements are discussed. (MCW)

6088 (COO-3243-3, pp 56-61) UNCERTAINTIES IN MIXED-FIELD DOSIMETRY. Goodman, L. J. 1 Jul 1974.

In annual report on research project.

Equations are given and discussed for use in evaluating the separate doses of neutrons and gamma rays in a mixed field using two detectors. The uncertainty in neutron absorbed dose in mixed fields due to uncertainty in the neutron sensitivity of the detectors is emphasized. (WHK)

6089 (COO-3243-3, pp 62-67) GAS AMPLIFICATION STUDIES: ONE INCH WALL-LESS COUNTER. Dvorak, R. 1 Jul 1974.

In annual report on research project.

Measurements to show that for the one inch diameter wall-less counter, the gas multiplication is independent of the number of ions in the initiating event over a wide range of event sizes are described. (WHK)

6090 (COO-3243-3, pp 68-77) EVENT DISTRIBUTIONS FROM MONOENERGETIC PHOTONS. Dvorak, R.; Gross, W. 1 Jul 1974.

In annual report on research project.

Data on event distribution in the one inch wall-less counter resulting from monoenergetic photon irradiation are presented and discussed. (WHK)

6091 (COO-3243-3, pp 78-87) EVENT DISTRIBUTIONS FROM ^{60}COBALT GAMMA RAYS. Dicello, J. F. 1 Jul 1974.

In annual report on research project.

A Rossi-type walled spherical proportional counter was used in the study. The counter was 2.5-cm diameter and had a wall thickness of 3 mm and a 2.5-cm diameter spherical chamber of tissue equivalent plastic, 3 mm thick, with a 64 μm stainless steel anode. Data are given and discussed. (WHK)

6092 (COO-3243-3, pp 116-126) CONDITIONS FOR MICRODOSIMETRY IN REGIONS OF DIAMETER LESS THAN 0.1 μm. Kellerer, A. M. 1 Jul 1974.

In annual report on research project.

The spatial distribution of energy deposition in particle tracks was studied. The approach is based on the principle that positive ions are extracted from a region of intermediate pressure into a region of low pressure and are then registered in a detector, such as an electron multiplier or solid state detector. The experimental setup is described. (WHK)

6093 (COO-3243-3, pp 127-137) CONDITIONS FOR MICRODOSIMETRY IN REGION OF DIAMETER LESS THAN 0.1 μm. Kellerer, A. M.; Teedla, P. 1 Jul 1974.

In annual report on research project.

The essential problem in microdosimetric measurements in regions below approximately 0.25 micrometer diameter is that the pressure is too low for gas modification in the sensitive region and too high for registration in electron multipliers or solid state detectors. Methods have therefore been considered in which ions are extracted into a region of reduced pressure and are there accelerated towards a detector. This approach has the important advantage that it can be applied to positive as well as negative ions. However, as far as the registration of negative ions is concerned one can also consider the possibility of transferring the ions into a region of increased pressure and of using gas multiplication in this region. This method is considered. An

alternative is extraction of the ions from the sensitive region and multiplication in a constant electrical field outside the sensitive region. This possibility is also discussed. (WHK)

6094 (COO-3243-3, pp 151-154) DEVELOPMENT OF COMPREHENSIVE DOSIMETRY APPARATUS AT RARAF. Mills, R. E.; Colvett, R. D. 1 Jul 1974.

In annual report on research project.

The development of precise voltage-to-frequency converters, a study of the neutron dose response of a G-M counter used as a neutron-insensitive gamma dosimeter, and the PDP8e minicomputer system are briefly discussed. (WHK)

6095 (ORNL-4979, pp 70-72) NaI(Tl) SCINTILLATION DETECTOR FOR SPECTROMETRY AND DOSIMETRY OF MEDICAL DIAGNOSTIC X RAYS. Stansbury, P. S.; Poston, J. W.; Warner, G. G. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

A directional NaI(Tl) detector for x-ray dosimetry at 10 to 130 keV in the MR ADAM phantom is briefly described. The experimental plan for the study is outlined. (WHK)

6096 (ORNL-4979, pp 209-221) SOLID-STATE DOSIMETRY RESEARCH. Becker, K.; Abdel Razek, M.; Cheka, J. S.; Gammage, R. B.; Haywood, F. F.; Jun, J. S.; Moreno y Moreno, A.; Saheli, N. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Work in spark counting and etching of dielectric tract detectors for neutron dosimetry, thermoluminescent dosimetry, and thermally stimulated exoelectron dosimetry is reviewed. (WHK)

6097 (ORNL-4979, pp 241-246) SPECTROMETRIC DOSIMETRY. Thomgate, J. H.; Christian, D. J.; McDowell, W. J.; Perdue, P. T.; Shinpaugh, W. H.; Sumner, G. K. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Topics include application of pulse-shape discrimination to liquid scintillation alpha spectroscopy, spectra of unscattered gamma rays with energies greater than 1.8 MeV that come from the Health Physics Research Reactor during its operation, and organic scintillator research. (WHK)

6098 FIBER-OPTIC GLASS DOSIMETRY. Evans, B. D.; Sigel, G. H. Jr.; Ritz, V. H. (Naval Research Lab., Washington, DC). Trans. Amer. Nucl. Soc.; 19: 46-47(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6099 MICRODOSIMETRY WITH THE NRL CANCER THERAPY FAST-NEUTRON BEAM. August, L. S. (Naval Research Lab., Washington, DC); Theus, R. B.; Attix, F. H.; Bondelid, R. O.; Shapiro, P.; Surratt, R. E.; Rogers, C. C. Trans. Amer. Nucl. Soc.; 19: 51-52(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6100 TIME-OF-FLIGHT DOSIMETRY. Shapiro, P. (Naval Research Lab., Washington, DC); Theus, R. B.; Surratt, R. E.; August, L. S.; Attix, F. H.; Bondelid, R. O.; Rogers, C. C. Trans. Amer. Nucl. Soc.; 19: 52-53(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6101 MEASUREMENT OF DOSE COMPONENTS IN AN n-γ FIELD. Attix, F. H. (Naval Research Lab., Washington, DC); Theus, R. B.; Rogers, C. C. Trans. Amer. Nucl. Soc.; 19: 53 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6102 ENERGY-DEPENDENT RESPONSE OF LITHIUM FLUORIDE TLDs. Van Prooyen, J. A.; Johnson, W. R. (Univ. of Virginia, Charlottesville). Trans. Amer. Nucl. Soc.; 19: 476-477(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6103 IMPROVED CALORIMETRIC MEASUREMENT OF BREMSSTRAHLUNG DOSE. Lockwood, G. J.; Miller, G. H. (Sandia Labs., Albuquerque, NM). Trans. Amer. Nucl. Soc.; 19: 478-479(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6104 GEOMETRIC CORRECTION FOR SPHERICAL ION CHAMBERS. Khandelwal, G. S. (Old Diminion Univ., Norfolk, VA); Costner, C. M.; Wilson, J. W. Trans. Amer. Nucl. Soc.; 19: 481(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6105 SHIMADZU RADIOTHERAPY PLANNING SYSTEM DOSEPAC 1000. Hattori, H. (Shimadzu Seisakusho Ltd., Kyoto); Ishihara, H.; Yamaoka, N.; Toyama, H.; Matsui, K. Shimadzu Hyoron; 31: No. 1-2, 15-24(Jun 1974). (In Japanese).

The DOSEPAC-1000, a newly developed radiotherapy planning system, is a powerful tool for complex dose calculations in radiation therapy. It calculates dose distributions for up to 10 combinations of fixed and moving beam therapy. The total dose over a predetermined area is rapidly calculated and displayed on a cathode ray tube. It calculates doses at more than 20,000 points over a calculation field of 32 × 40 cm. The distance between the grid points is only 2.5 mm. The calculation of area dose, therefore, can be done with excellent accuracy. The system permits dose calculations for a wide spectrum of radiation including x-rays, electrons, as well as radium needles and so on. It can store on a magnetic disc, therapy records for up to 150 patients. The system can be used as a radioisotope data processing system, by adding appropriate interface boards and changing a disc cartridge, which stores all programs for nuclear medicine. (auth)

6106 A READER FOR RPL DOSEMETERS. (to Foerstner und Co., K. G., Ladenburg/Neckar (F. R. Germany)). Austrian Patent 11445/68/A1. 25 Nov 1968. 8p. (In German).

Available from Oesterreichisches Patentamt, 1010 Vienna.

A reader for rpl dosemeters is described which uses a certain number of equidistant light pulses for exciting the fluorescing centers in rpl-dosemeters. By measuring the average intensity of the fluorescent light results are remarkably improved. (INIS)

6107 RADIATION EXPOSURE RECORD-KEEPING BY TIME-SHARING COMPUTER. Holeman, G. R.; Shaw, D. M. M. (Yale Univ., New Haven). Health Phys.; 27: No. 4, 396-399(Oct 1974).

An investigation has been made of the use of a remote terminal timesharing computer for the storage and maintenance of occupational radiation exposure records to facilitate the rapid retrieval of personnel radiation exposure information. The computer system chosen and the software developed are easy to operate with instant access and retrieval of film badge data. The computer program CREATE written in FORTRAN is described. The system strikes a realistic balance between sophistication and expense. (UK)

6108 AUTOMATED THERMOLUMINESCENT DOSIMETRY (TLD) SYSTEM FOR PERSONNEL MONITORING. I. System Description and Preliminary Results. Cox, F. M.; Lucas, A. C. (Harshaw Chemical Co., Solon, OH). Health Phys.; 27: No. 4, 339-345(Oct 1974).

An automated TLD system for large scale personnel monitoring has been designed and constructed. The dosimeter contains two detectors which may be used to: provide redundancy, discriminate between β and γ rays, detect neutrons and measure γ rays. The dosimeter, called a card, is configured similarly to a standard film packet to simplify interfacing the system with existing badging methods. Six digit identification is provided on each card. The binary coded decimal identification is read automatically as the card passes through the readout instrument. Readout and identification data are available in computer compatible format. A teletypewriter provides redundant hard copy and punched tape. A number of systems are now in routine use. Laboratory experiments and early field experience have demonstrated that the dosimeters are reusable for at least 50 operations and that the detectability of the system is well beyond that routinely attained in film dosimetry. (auth)

6109 USE OF PRESSED LiF FOR THERMOLUMINESCENCE DOSIMETRY WITHOUT FURNACE ANNEALING. Ehrlich, M. (National Bureau of Standards, Washington, DC). Phys. Med. Biol.; 19: No. 5, 725-731(Sep 1974).

An alternative method to the time-consuming furnace annealing of LiF thermoluminescence dosimeters is described. Bare extruded LiF plaques annealed in a conventional reader subsequent to the read-out of thermoluminescence were employed. The heating cycle during read-out was adjusted so as to produce essentially complete annealing while keeping the maximum heating temperature below the level which produces appreciable sensitivity losses. The procedure could be employed with relatively high reproducibility of results, and practical convenience, throughout the medical irradiation range for studies requiring the use of LiF. (UK)

6110 COMPARISON OF THERMAL NEUTRON AND GAMMA RAY SENSITIVITIES OF COMMON TLD MATERIALS. Ayyangar,

K.; Lakshmanan, A. R.; Chandra, B.; Ramadas, K. (Bhabha Atomic Research Center, Bombay). Phys. Med. Biol.; 19: No. 5, 665-676(Sep 1974).

The thermal neutron responses in the range 10^{10} to 2×10^{12}n cm^{-2} and the γ-ray sensitivities of common thermoluminescent materials ($CaSO_4$: Dy, $CaSO_4$: Tm, CaF_2: Dy, CaF_2: Mn, $Li_2B_4O_7$: Mn, LiF (TLD-700, TLD-100, TLD-600), Mg_2SiO_4: Tb and BeO) have been studied in detail and the results compared with those published elsewhere. The variation of thermal neutron response as a function of sample thickness has been studied in detail in the case of $Li_2B_4O_7$: Mn and was found to decrease with the sample thickness, due to self-shielding, and with the thermal neutron fluence used, due to the difference in TL supralinearity of these materials to thermal neutrons and γ-rays. The variation in thermal neutron response quoted by different authors for Li based materials (such as $Li_2B_4O_7$: Mn, TLD-600 and TLD-100) is attributed to these two factors, stressing the importance of using thin layers of phosphors and a low thermal neutron fluence during irradiation. Other TLD materials used for this study have shown a linearity in the fluence range 10^{10} to 2×10^{12}n cm^{-2}. $CaSO_4$: Dy, $CaSO_4$: Tm and Mg_2SiO_4: Tb have very low thermal neutron responses (0.38, 0.21 and 0.21 equivalent R per 10^{10} n cm^{-2} respectively) coupled with high γ-ray sensitivity. $CaSO_4$: Dy was found suitable for γ-ray dosimetry in mixed fields. TLD-600 has the highest thermal neutron response (1520 equivalent R per 10^{10}n cm^{-2}) studied and was found suitable for thermal neutron measurement. The response of $CaSO_4$: Dy to thermal neutrons and γ-rays in a mixed field was found to be truly additive. There has been no permanent damage observed to the γ-ray sensitivity of $CaSO_4$: Dy even after irradiation by a thermal neutron fluence of 10^{12}n cm^{-2}. (auth)

6111 MIXED FIELD DOSIMETRY WITH $CaSO_4$: Dy. Ayyangar, K.; Chandra, B.; Lakshmanan, A. R. (Bhabha Atomic Research Center, Bombay). Phys. Med. Biol.; 19: No. 5, 656-664 (Sep 1974).

The thermal neutron response and γ-ray sensitivity of $CaSO_4$: Dy as a function of Dy concentration were studied in detail. $CaSO_4$ with 0.2% Dy has maximum γ-ray sensitivity. The thermal neutron response of $CaSO_4$: Dy increased rapidly with concentration beyond 0.1% Dy. $CaSO_4$: 0.05% Dy (or Tm) had high γ-ray sensitivity coupled with low thermal neutron response and hence is useful for γ-ray dosimetry in mixed fields. A mixture of LiF TLD-100 and TLD-700 was arrived at for rem equivalent dosimetric purposes in a mixed field consisting of thermal and intermediate energy neutrons and γ-rays. Mixtures of $CaSO_4$: Dy with various lithium based materials were also selected for the same purpose. The thermal neutron response and glow peak temperature of $CaSO_4$: (Dy, ^{6}Li) were studied as a function of ^{6}Li concentration. (auth)

6112 SPECTRAL DEPENDENCE OF THE $FeSO_4$ G-VALUE IN DT NEUTRON BEAMS. Law, J. (Western General Hospital, Edinburgh); Lawson, R. C.; Porter, D. Phys. Med. Biol.; 19: No. 5, 643-655(Sep 1974).

Ferrous sulphate G-values for DT neutron beams have been measured using ionization dosimetry based on a number of different ion chamber systems. Measurements were made in neutron beams with (a) minimum scattering material present so that only 13% of the neutron dose was due to low energy neutrons (mean energy approximately 1.3 MeV), and (b) a uranium block in the beam to increase the low energy neutron component to about 57% (mean energy approximately 1.5 MeV). In both cases the γ-ray component was only about 5%. The results for the mixed neutron and γ-ray beams were (a) 9.7 ± 0.6 and (b) 8.8 ± 0.6. G-values for neutrons of nominal energy 14.3 MeV and 1.5 MeV were estimated from these results to be 9.6 ± 0.6 and 7.6 ± 0.9. These compare well with other values recently reported both for 14 MeV neutron beams and for californium radiation. A G-value of 9.9 ± 0.6 is suggested as suitable for determining the total dose in a mixed radiation field for both DT neutron beams and californium radiation under a wide range of scattering conditions. (auth)

6113 METHOD FOR MEASURING DOSE RATE OF ELECTRON IRRADIATION BY THE USE OF A TEMPERATURE-SENSITIVE RESISTIVE ELEMENT. Yoshida, T.; Fujino, T.; Oka, T.; Shono, Y. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 44-47 (1973).

A method for measuring the dose rate of electron irradiation is described which is based on the energy dissipation of the electron beam in a small temperature sensitive element. The dissipated energy causes temperature rise of the resistive element and change in resistance which then serves as an indication of the dose rate. A preliminary experiment was made where tungsten filaments were used as the resistive element. The present method may be used for measuring the average energy of the electron beam and the stopping power in the resistive element. (auth)

6114 AUTOMATION OF THE MEASURING PROCESS INVOLVED IN PLOTTING AND TRANSMISSION OF EXPOSITION UNIT IN ASMW. Schulz, G.; Kuehne, W.; Lundie, H. (Bereich Messwesen, Fachabteilung Ionizierende Strahlung, Berlin). Isotopenpraxis; 10: No. 8, 306-308(Aug 1974). (In German).

A device is described which provides vast automation of the measuring process involved in plotting and transmission of the exposure unit. The core of the device is an electronic control unit connected with the charge measuring units of the monitor and standard chambers. Highly stabilized triggers are used to control the measuring process. (auth)

6115 CALIBRATION OF DOSIMETERS FOR THE MEASUREMENT OF HIGH GAMMA-RADIATION INTENSITY. Kopas, N. F. (Inst. of Nuclear Research, Kiev). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 699-700(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 66-67(1974).

A method is described for calibrating γ dosimeters in relative measurement units with an accuracy determined solely by the accuracy of the calibrated dosimeter itself and not requiring a standard dosimeter. In order to obtain absolute calibration it is sufficient to compare the dosimeter with a standard for the same intensity of the γ source. (auth)

Nuclear Spectroscopic Instrumentation

Refer also to abstracts 6756, 7363, and 7450.

6116 (AD-781280) MAZE 3: A SEQUENTIAL COMPUTER SPECTRAL ENHANCEMENT CODE: STUDIED FOR CONVERSION TO ILLIAC IV. Final Report, 1 November 1972-31 January 1974. Huszar, L.; Reed, J. H.; Sperling, M. (Science Applications, La Jolla, Calif. (USA)). Dec 1973. Contract DNA001-73-C-0026. 74p. (SAI-73-649-LJ). NTIS $3.75.

A mathematical model is described which forms the basis of a spectral enhancement program that follows along the lines of the MAZE series of spectral unfolding codes. The treatment of a priori and a posteriori information functions are elaborated as well as their optimization and subsequent implementation. The code was developed for a serial computer and the results are demonstrated for several examples. The code has also been converted to the ILLIAC 4 parallel processor computer system in the GLYPNIR language. (auth)

6117 (JAERI-M-5734) Si(Li) PHOTON SPECTROMETERS. Ishii, M.; Kyozuka, M. (Japan Atomic Energy Research Inst., Tokyo). Jun 1974. 25p. (In Japanese). NTIS (U. S. Sales Only).

Technical information is presented to enable the fabrication of Si(Li) photon spectrometers. The first chapter describes a simple method of fabricating Si(Li) diodes. For convenience of fabrication the procedure is presented in a flow chart. The second chapter deals with opto-electronic feedback preamplifiers used in the spectrometers. Methods for adjusting the photocoupling of a light-emitting diode and an FET at room temperature are described. This saves effort, and enables one to set up the opto-electronic feedback system as easily as the resistive one. Finally, the performance of Si(Li) photon spectrometers thus built is discussed. (auth)

6118 (LA-5772-MS) SUBROUTINES CALLABLE FROM PDP-11 BASIC FOR CONTROL OF A MULTICHANNEL PULSE-HEIGHT ANALYZER. East, L. V. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 4p. Dep. NTIS $4.00.

A set of subroutines written to control a multichannel pulse-height analyzer interfaced to a PDP-11 minicomputer is described. These subroutines allow programs written in BASIC to perform all control and data transfer functions required to accumulate and analyze pulse-height spectra. (auth)

6119 (UUIP-853) TECHNIQUE FOR ON-LINE MEASUREMENTS OF 10 ps NUCLEAR LIFETIMES USING AN ELECTRON-ELECTRON COINCIDENCE SPECTROMETER. Lindskog, J.; Svensson, L. G. (Uppsala Univ. (Sweden). Fysiska Institutionen). Mar 1974. 18p. Dep. NTIS (US Sales Only) $4.00.

An electron-electron coincidence spectrometer has been connected on line to the tandem accelerator in Uppsala and provided with electronic stabilizing circuitry which allows delayed coincidence measurements of short nuclear lifetimes with an accuracy of down to 5 ps. (auth)

6120 ANALYTICAL FUNDAMENTALS OF THE SIEMENS COMPUTER PROGRAMS FOR X-RAY SPECTROMETRY. Plesch, R. (Siemens A. G., Karlsruhe (F. R. Germany). Geschaeftsbereich Messund Prozesstechnik). Siemens-Z.; 48: No. 5, 355-360(May 1974). (In German).

2 figs.; 3 refs.

For the physical data, the basic construction of the programme is illustrated and the interpretation of the measured results is explained. The X-ray spectrometry with outer standards, which is the most frequently used method in X-ray analysis is taken as a basis. (GE)

6121 SPHERICAL ANALYZER WITH PRE-RETARDATION. Polaschegg, H. D. (Leybold-Heraeus G.m.b.H. und Co. K. G., Koeln (F R. Germany)). Appl. Phys.; 4: No. 1, 63-68(Jun 1974). 5 figs.; 18 refs.

The features of the spherical analyzer with and without pre-retardation are compared. The results are applicable to other types of spectrometers as, e.g., the cylindrical analyzer and the cylindrical mirror. (auth)

6122 CHARACTERISTICS OF A DIRECT-COUPLED MAIN AMPLIFIER. Shimokoshi, F. (Tokyo Univ.). pp 50-54 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

The principal role of a main amplifier is to improve S/N ratio by incorporating a suitable filter. The conventional ac-coupled main amplifier causes base-line shift or fluctuation due to the statistically generated pulses of radiation, and hence degrades energy resolution. In the case of direct-coupled main amplifiers, the above points are well improved and it performs with high resolution and high count. The improvement resulted from the adoption of a negative feedback circuit to feed back the difference between output and reference voltage, which contains an RC integration circuit and a diode clamping circuit. This is called a compound high-pass filter which gives the similar effect to the ac-coupled amplifier. The circuit operates as the compound high-pass filter when the clamping voltage E_c is small, but shows the condenser-coupled-like characteristic of exponential decay when E_c is large, ceasing filtering action by being clamped with a diode. As an example, a resolution of 2.11 keV for ^{60}Co was obtained by using a 50 cc coaxial Ge(Li) detector and employing an externally connected preamplifier. (JA)

6123 ELECTRONICS IN THE GAMMA-RAY SPECTROMETER WITH A SEMICONDUCTOR DETECTOR. Kumahara, T. (Japan Atomic Energy Research Inst., Tokai). pp 32-49 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

From investigation on the relationship between energy resolving capability and general characteristics of electronic instruments in gamma-ray spectrometers using semiconductor detectors, optimization of performance of the amplifying system is important. A technical survey on high-resolutions amplifiers is given, and a drain-gate pulse-feedbacked charge sensitive preamplifier is detailed. (auth)

6124 GaAs SEMICONDUCTOR DETECTORS. Kobayashi, T. (Tokyo Shibaura Electric Co. Lt., Kawasaki, Japan). pp 15-31 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

Gallium arsenide surface barrier diodes have been fabricated from high purity level GaAs materials. These devices have an Au surface barrier having a depletion layer thickness of from 70 μm to 1 mm and an area of from 3 mm^2 to 27 mm^2. These devices have been operated as α-particle, β-ray, and γ-ray spectrometers and detectors. The best energy resolutions taken with a GaAs detector made from liquid phase epitaxial GaAs wafer were 20 keV (fwhm) and 8 keV for 5.486 MeV α-particles from ^{241}Am and 115 keV conversion electrons from ^{57}Co at room temperature, respectively. The detector had 4 keV energy resolution for ^{241}Am γ-rays at room temperature. For room temperature applications, a simple charge sensitive preamplifier using two FETs and one OP amp and an encapsulated GaAs detector were constructed and evaluated. The energy per electron-hole pair in GaAs was measured at 4.35 ± 0.02 eV for α-particles with a linear variation with bandgap energy of 2.53 over a temperature range 195 K to 330 K. The state-of-art for compound semiconductor detectors is discussed briefly. (auth)

6125 PRECISE MEASUREMENT OF THE CONVERSION ELECTRONS WITH THE INS BETA-RAY SPECTROMETER. Kawakami, H. (Tokyo Univ.). pp 111-112 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

Precise measurement of conversion electrons with the INS $\sqrt{2}$ π β-ray spectrometer is described. Details of the energy calibration and the improvement of S/N ratio are explained. In order to improve the facility, stabilization of the main power supply and the use of the multiwire proportional counter system for the detection of the electrons are reported. (auth)

6126 MEASUREMENT OF INTERNAL CONVERSION ELECTRONS BY AIR-CORE BETA-SPECTROMETER IN THE INSTITUTE OF PHYSICAL AND CHEMICAL RESEARCH. Hashizume, A. (Inst. of Physical and Chemical Research, Wako, Japan). pp 113-122 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

Until about 10 years ago, those employed as spectrometers of high resolution were magnetic β-spectrometers and bent crystal type γ-spectrometers. Recently semiconductor detectors have come to the front, while $\sqrt{2}$ π type air-core (no iron) coil β-spectrometers are used. The type of spectrometer installed in the Institute of Physical and Chemical Research is of the Chalk River type (current 100 p type) of 50 cm mean radius. There are various disturbances in the magnetic field though it is generated precisely. The main disturbances are the effect of terrestrial magnetism, magnetization of structural material, and the effect of traffic vehicles. As for radioisotope sources, thin sources that are able to neglect self absorption within the area of less than 1 mm wide and about 20 mm long are required to obtain the necessary resolution. The maximum resolution obtained so far is 0.026% in momentum fraction, which was obtained for 411.8 keV internal conversion electrons accompanying ^{198}Au decay. As an example of the complex spectrum, the measured results of γ-ray emitted in the decay of ^{147}Gd → ^{147}Sn → ^{147}Sm are shown. The Auger electron spectra are also obtained with an estimated energy error of 0.10 keV. (JA)

6127 LARGE SCINTILLATION DETECTOR SYSTEM FOR FAST NEUTRON TIME OF FLIGHT. Julien, P. F. Ann Arbor, MI; Univ. of Michigan (1974). 223p. University Microfilms Order No. 74-25,232.

Thesis (Ph. D.).

A neutron time-of-flight detector system of large volume was developed having sufficient time resolution to allow spectroscopic studies of nuclides via (particle, n) reactions at accelerator beam energies on the order of 20 MeV. The system consists of a closely packed array of ten one-liter liquid scintillation detectors, each coupling its photomultiplier directly to a nine-inch diameter scintillator tank and each having its own fast timing discriminator. The linear and fast timing signals from the ten detectors are added separately. The large volume of scintillator allows high resolution neutron time-of-flight spectra to be obtained over neutron flight paths extending to 40 meters while maintaining a relatively large solid angle and detection count rate. Using The University of Michigan 83-inch cyclotron, neutron and target gamma-ray time-of-flight spectra were obtained which show the gamma ray time resolution of the system is 0.9 nanoseconds FWHM and the neutron time resolution about 1.0 nsec ± 0.1 nsec. These spectra were obtained at 23 meters with a minimum of calibration procedure and operational difficulty. Photon emission-collection statistics and circuit noise were found experimentally to contribute only a small fraction of the observed 0.9 nsec detector time spread. To find the origin of the remaining time spread the time resolution of an individual detector was calculated using Monte Carlo techniques. The time response of the liquid holding tank to a light flash having the form of a delta function in time was calculated and the result convoluted with the scintillator and photomultiplier response functions. This model showed a time spread of 0.9 nsec FWHM in low leading edge triggering mode for a nine-inch diameter scintillation tank and was found to result from a pulse shape distortion effect rather than photon statistics. This model represents a new approach to the problem of time resolution in extended scintillators. In order that absolute neutron fluxes might be determined the neutron detection efficiency was calculated as a function of incident neutron energy. (Diss. Abstr. Int., B)

6128 MAGNETIC ANALYZER WITH HIGH RESOLUTION THAT USES A LARGE ENERGY RANGE OF INCIDENT PARTICLES. Litvin, V. F.; Krasnov, L. V.; Semenov, V. M. Vestn. Leningrad. Univ., Fiz., Khim.; No. 1, 78-82(Feb 1974). (In Russian).

The ion optics of the magnetic analyzer for the nuclear reaction products with high resolution for an energy of the emergent particles was investigated. The analyzer uses a large energy range of the incident particles. The characteristics of the analyzer for the study of elastic and inelastic scattering of ions are presented. (auth)

6129 ACCURATE GAMMA-MEASUREMENT WITH Ge(Li) DETECTOR. Yoshizawa, Y. (Hiroshima Univ.). pp 55-71 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

Ge(Li) detector has some advantages such as excellent resolution as compared with NaI(Tl) detector, easy analysis due to the peak shape approximate to Gaussian distribution, and simple handling. In ordinary γ-measurement, the 10 to 60 cc coaxial Ge(Li) detector is employed, which has FWHM of 2 to 3 keV for 1.33 MeV γ-ray of ^{60}Co. The approximate standard to decide the deviation of peak shape from Gaussian form is obtained by the ratio of FWTM to FWHM over 2.0, FWTM being the full width of a tenth maximum. The method of determining peak center is important because it is the basis of energy determination. The accuracy of computer-aided determination of the peak center carried out by the author is ±0.05 channel, though enough counts and correct subtraction of Compton background are required. Linearity of the system is also important for the accurate determination of energy. The intensity of γ-ray is measured by integrating photoelectric peak. Among a few existing methods of integration, the author obtained the integration by summing up counts within FWTM and subtracting the background around peak. (JA)

6130 SSDs (SILICON SURFACE-BARRIER DETECTOR) IN THE KYUSHU UNIVERSITY. Uehara, S.; Kato, N.; Kuroyanagi, T.; Onizuka, Y.; Mitarai, S. (Kyushu Univ., Fukuoka). pp 94-110 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

A silicon surface barrier detector having 1.3 mm thick depletion layer has been fabricated by using a type material of Si of 15 kΩcm resistivity. In ^{27}Al(d,p) and ^{72}Ge(d,p) reactions, the proton spectra have been measured with the FWHM of 13 and 15 keV, respectively. In the measurements, the noise due to reverse leakage current is reduced by lowering the detector temperature to 127°K and effect of ejected electron from the target is rejected by use of an electron sweep magnet. Pile up effect of intense elastic scattering in the reaction is suppressed with a simple pile up rejector. Also, Ge(Li) detectors of 20 to 44 cc have been fabricated. In the 44 cc detector the resolution is 1.7 and 2.4 keV FWHM for the gamma rays of 122 and 1332 keV, respectively. Furthermore, surface state of the intrinsic region of the detector has been studied by use of a collimated beam of low energy gamma ray. It is found that a thick dead layer exists on the surface of the intrinsic region and that a variation of distribution of the dead layer occurs for about 3 months. (auth)

6131 APPLICATION OF A Si(Li) DETECTOR TO THE NUCLEAR SPECTROSCOPY. Ishii, M. (Japan Atomic Energy Research Inst., Tokai). pp 72-93 of Nuclear Spectroscopy. Wako, Japan; Inst. of Physical and Chemical Research (1973). (In Japanese).

From symposium on nuclear spectroscopy; Wako, Japan (10 Mar 1972).

A summary of the features of Si(Li) detectors and their applications to the detection of photons and charged particles is presented. The remainder is devoted to the description of a beta- and Compton-suppressed spectrometer for the internal conversion study. (auth)

6132 LOW-LEVEL RADIONUCLIDE MEASUREMENT WITH THE ANTI-COMPTON Ge(Li) GAMMA-RAY SPECTROMETER. Miyake, H. (Kobe Univ. of Mercantile Marine, Japan). pp 135-143 of Nuclear Spectroscopy. Wako, Japan; Inst of Physical and Chemical Research (1973). (In Japanese)

From symposium on nuclear spectroscopy; Wako, Japan(10 Mar 1972).

An anti-Compton gamma-ray spectrometer has been developed which provides several characteristics for measuring low level mixtures of radionuclides in marine environmental samples. The detector assembly consists of a 42.7 cm^3 coaxial Ge(Li) detector and a well-type 6'' φ × 4'' NaI(Tl) detector for the anti-coincidence shielding. The sample is placed on the Ge(Li) detector inside the well of NaI(Tl) crystal. Suppression of Compton background is especially remarkable at the energy range of Compton edge under the operation of the anti-coincidence mode. The anticoincidence shield reduces the ^{137}Cs Compton edge by a factor of 6.6 to provide a peak to Compton edge ratio of 210 : 1 without reducing the full energy peak efficiency. The background counting rate is reduced by a factor of two at the energy range below 1 MeV and by a factor of more than ten at the energy range above 3 MeV by the anti-coincidence shield when the detector assembly is placed in the 100 mm thick lead shield cave. A few pCi of radionuclides, e.g., ^{137}Cs and ^{95}Zr, is detectable with the measurement for 50 hours. (auth)

6133 NEW AUTOMATIC GAMMA SPECTROMETER FOR ANGULAR CORRELATION MEASUREMENTS OF ANNIHILATION QUANTA CONSTRUCTED IN THE INSTITUTE OF EXPERIMENTAL PHYSICS OF THE UNIVERSITY OF WROCLAW. Rozenfeld, B.; Baranowski, A.; Jerie, K. (Univ. of Warsaw). Nukleonika; 19: No. 9, 817-822(1974). (In Polish).

A new completely automatic gamma spectrometer for angular correlation measurements of annihilation quanta has been constructed in the Institute of Experimental Physics of the University of Wroclaw. Time power resolution of this apparatus is better than $5 \cdot 10^{-9}$ s and angular power resolution is 0.8 mrad with the possibility to reach 0.25 mrad. (auth)

6134 BLOCK OF Ge(Li) DETECTORS HAVING A LARGE VOLUME. Svetashov, P. A.; Skakun, N. A.; Strashinskii, A. G.; Serykh, N. V.; Khomyakov, G. K. (Physical-Technical Inst., Kharkov). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 691-692(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 58-60(1974).

A counter is described for a γ spectrometer, which consists in three coaxial Ge(Li) detectors that are connected in parallel to one another and also to a single preamplifier. The useful detector volume is 110 cm^3. The parameters of the spectrometer are given. (auth)

High Energy Physics Instrumentation

6135 (LA-5749-MS) FAST VERSATILE PREAMPLIFIER FOR USE IN PARTICLE PHYSICS. Studebaker, J. K. (Los Alamos Scientific Lab., N. Mex. (USA)). Sep 1974. Contract W-7405-eng-36. 9p. Dep. NTIS $4.00.

A preamplifier with outstanding characteristics is described. It is built around an NE-592 monolithic integrated circuit. The amplifier has a negative output (0 to -5 V, typical), inverting as well as non-inverting inputs, excellent linearity, easily tailored gain and input impedance, 50Ω drive capability (delay line clipping may be used) and a total assembled cost of less than $25. It is readily adaptable to many detection schemes. (auth)

6136 DEVELOPMENT OF PARTICLE DETECTORS FOR HIGH ENERGY EXPERIMENTS. Charpak, G. (CERN, Geneva). J. Phys. (Paris), Colloq.; No. 10, 73-82(1973). (In French).

From centenary congress of the French Physical Society; Vittel, France (28 May 1973).

A comparison is made between the properties of the various particle detectors which have played an important role in the evolution of high energy physics. Some recent work on multiwire proportional chambers and drift chambers is discussed. (FR)

6137 ON-BOARD INSTRUMENTATION OF THE SCIENTIFIC STATION PROTON 4 FOR COSMIC RAY STUDIES. Grigorov, N. L.; Rapoport, I. D.; Savenko, I. A.; Kalinkin, L. F.; Kakhidze, G. P. pp 49-94 of Izuchenie Kosmicheskikh Luchei na Iskusstvennykh Sputnikakh Zemli. Shtern, M. I. (Ed.). Moscow; Izdatel'stvo Nauka (1973). (In Russian).

Instruments designed to record the energy and charge spectra of ultraenergetic (TeV) particles and to measure the effective cross section of inelastic interaction between protons and heavy and light nuclei are described. The spectrometer for recording high-energy particles, incorporating an ionization calorimeter with an absorber prepared from lead and iron, is discussed in some detail. The schematic diagrams of instruments used for recording quarks and measuring high-energy electron fluxes are given and discussed. (IAA)

6138 MEASUREMENT OF THE POLARIZATION OF RECOIL PROTONS IN ELASTIC πp SCATTERING BY THE DOUBLE-SCATTERING METHOD. Bekrenev, V. S.; Gordeev, V. A.; Kashchuk, A. P.; Kruglov, S. P.; Kuz'min, L. A.; Kulbardis, A. A.; Lopatin, I. V.; Makaev, T. G.; Suvorova, L. F.; Sumachev, V. V.; Tkach, I. I.; Filimonov, E. A.; Shchegel'kii, V. A.; Shcherbakov, G. V. (Leningrad Inst. of Nuclear Physics). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 680-683(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 50-53(1974).

An installation is described for measurement of the polarization of recoil protons in elastic πp scattering by the double-scattering method. The installation consists of 24 wire spark chambers with magnetostrictive takeoff of information for determining the spatial position of the trajectories of charged particles and a system for analyzing these particles according to the time of flight. The installation operates "on line" with an electronic computer. Results are presented of the first measurements performed at an energy of negative π mesons equal to T_π = 485 MeV. (auth)

Radiometric Instruments

6139 (AD-779422) DETERMINATION OF IN-PLACE MOISTURE AND DENSITY BY NUCLEAR METHODS. Final Report. Webster, S. L. (Army Engineer Waterways Experiment Station, Vicksburg, Miss. (USA)). Apr 1974. 27p. NTIS $3.25.

Recent advances in the design of nuclear equipment and a better understanding of the nuclear principles involved have led to increasingly widespread use of nuclear gages in earth construction control work. This report describes surface-type nuclear equipment, procedures, and various test methods used for making shallow-depth moisture and density determinations in place on soil and soil-aggregate mixtures. In general, a 6-in. direct transmission density test using a properly operating nuclear gage and an up-to-date factory calibration curve will yield test results slightly better than those of conventional density tests. The nuclear test is simpler to perform than conventional tests and requires only about 15 min to obtain both a density and moisture test result. (auth)

6140 (AD-782095) OPTIMUM FILTER MODELING OF INTEGRATED CIRCUITS. Final Report, 1 December 1970–31 May 1972. Chao, K. S.; Liberty, S. R.; Seacat, R. H.; Chipman, M. A. (Texas Tech Univ., Lubbock (USA)). Jun 1974. Contract F29601-71-C-0048. 117p. (AFWL-TR-72-121). NTIS $4.50.

The report provides a complete and unified description of variations on the Wiener theory for modeling nonlinear systems. In particular, applications to the modeling of integrated circuit operational amplifiers in an ionizing radiation environment are considered. Detailed investigations of four modifications of the Wiener method are discussed (Lee's method, the indirect method, Bose's method, and the matrix method), as well as extensions of the Wiener theory to include time varying and multiple-input multiple-output systems. It is shown that the matrix method is the best of the methods investigated. A modeling technique based upon this method is presented including a FORTRAN subprogram which can be used in conjunction with the SCEPTRE circuit analysis program. (auth)

6141 (AED-CONF-74-312-001) CONTINUOUS MEASUREMENT OF COMBUSTION RATE OF SOLID ROCKET FUELS WITH A GAMMA RAY BARRIER. Frauenfelder, R. (Staedtisches Auguste-Viktoria-Krankenhaus, Berlin-Schoeneberg (F. R. Germany). Strahlenabteilung). 1974. 10p. (In German). INIS.

From international annual meeting on combustion processes in propellants and fuels; Karlsruhe, F. R. Germany (26 Jun 1974).

4 figs.; 1 ref. With abstract.

Continuous measurement of the combustion rate of solid fuels allows the recording of the combustion rate/pressure function in a single step. The method of the gamma-ray barrier has the advantage of being less fault-prone and applicable also to not yet cured propellants. For the experiments described, a barrier consisting of a 150 mCi ^{137}Cs-source, a lead collimator and a NaI (Tl) scintillation detector has been used. This gamma-ray barrier is made to continuously follow the combustion front of a front-line burner with a diameter of 30 mm which is fixed in a burner vessel. Combustion rates of up to 60 mm/s at a pressure of up to 300 at. can be measured with this arrangement. (auth)

6142 (BARC-741) RADIOISOTOPE GAS LEAK DETECTOR USING INACTIVE TRACERS. Krishnamurthy, K.; Rajagopalan, R.; Nair, A. R. (Bhabha Atomic Research Centre, Bombay (India). Isotope Div.). 1974. 25p. Dep. NTIS (US Sales Only) $4.25.

The principle that the electron affinity gases such as SF_6 and Freons can be detected with high sensitivity with ion collection methods has been used in the development of the gas leak detector. This detector is sensitive to SF_6 concentrations as low as 10^{-10} cc/cc of air and can detect leak rates of 5×10^{-10} std cc/sec of SF_6. Based on the use of tritium titride as the source of ionizing radiation, the development of a new detector design was attempted. The effect of operational parameters such as the carrier gas flow rate and the polarizing voltage on the detector response were studied in detail. The detection characteristics of this detector compare favorably with those of other detection techniques such as the radiotracer method and the helium mass spectrometers besides avoiding the complexities associated with the latter methods. In addition, this unit is rugged, cheap, portable, and battery operated and is suitable for field applications. (auth)

6143 (EURISOTOP-92) TECHNICAL AND ECONOMIC STUDY OF AUTOMATIC CONTROL OF EXTRUDED PLASTIC SHEET WITH BETA GAUGES. Bristow, J. D. (Commission of the European Communities, Brussels (Belgium). Bureau Eurisotop). Nov 1974. 22p. Dep. NTIS (US Sales Only) $4.25.

The integration of a nucleonic gauging and control system with a plastics extrusion process is described. The achievements of the system and the part it plays in improving cost benefit ratios, efficiency, and process optimization are outlined. The equipment basically consists of one scanning measuring head and a set of electronic modules to process, display and record the information collected. A control system supplies the necessary corrective action to maintain the material within close tolerance limits. Methods of production and technical comparisons vary with different processes and with different manufacturers, however the principles utilized can generally be adapted to suit most applications. (auth)

6144 (UCID-16607) BETA-RADIATION BACKSCATTER MEASUREMENTS OF ALUMINUM ON PLASTIC. Taylor, G. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 Oct 1974. Contract W-7405-eng-48. 11p. Dep. NTIS $4.00.

The beta-backscatter method of measuring the thickness of an aluminum coating on a plastic substrate is described. The degree of accuracy that can be obtained for various assumed calibration standards and counting times is estimated. A 95% confidence level of ±2% is estimated when each count is for 1000 s, and five standards are available with an estimated accuracy of ±0.4%. (auth)

6145 A NEW RADIOACTIVE METHOD FOR THE CONTINUOUS MEASUREMENT OF THE AIR CONTENT IN OIL DURING ENGINE OPERATION. Fock, M. (Volkswagenwerk A. G., Wolfsburg (F. R. Germany). Hauptabteilung Messtechnik-Forschung). Erdoel Kohle, Erdgas, Petrochem.; 27: No. 6, 312-315 (Jun 1974). (In German).

5 figs.; 2 refs.

A radioactive method based on the γ-ray absorption has been developed for contactless continuous determination of air in the engine lubricating oil (oil foaming). ^{241}Am is used as source of γ-radiation. The pulse rate at the end of the path of measurement is related to the air content in oil. The level of accuracy is better than 0.5%. (auth)

6146 ON THE DIFFICULTIES ENCOUNTERED IN MEASURING THE MOISTURE CONTENT OF MATERIALS. Lueck, W. Regelungstech. Prax. Prozess-Rechentech.; 16: No. 3, 60-65 (Mar 1974). (In German).

8 figs.; 1 tab.; 3 refs.

On-line humidity measurement can be performed by means of direct methods and indirect methods (electric conductivity, dielectric measurement, IR, and neutron gages). The selectivity of such humidity measurement methods has to be balanced against possible disturbances for on-line operation. This problem is discussed in detail for the above-mentioned indirect methods. (auth)

6147 SENSITIVITY VARIATIONS DUE TO SECONDARY EXCITATIONS IN X-RAY FLUORESCENCE COATING GAUGES. Notea, A.; Segal, Y. (Technion–Israel Inst. of Tech., Haifa). Trans. Amer. Nucl. Soc.; 19: 78-79(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6148 DUAL GAUGING UTILIZING PENETRATING AND SCATTERED PHOTONS. Elias, E.; Segal, Y.; Notea, A. (Technion–Israel Inst. of Tech., Haifa). Trans. Amer. Nucl. Soc.; 19: 79-80(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6149 APPLICATION OF THE DUAL-GAUGE PRINCIPLE TO SURFACE-TYPE NEUTRON MOISTURE GAUGES. Dunn, W. L. (Carolina Power and Light Co., Hartsville, SC); Gardner, R. P. Trans. Amer. Nucl. Soc.; 19: 80-81(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6150 RADIOLOGICAL WELL LOGGING METHODS AND APPARATUS. Arnold, D. M.; Pitts, R. W. Jr. (to Texaco Development Corp.). Canadian Patent 951,438. 16 Jul 1974.

Improved radioactivity well logging methods and apparatus are provided for determining the macroscopic thermal neutron capture cross section of subsurface earth materials, wherein an adjustment is made to reduce or eliminate the portion of the measurement which is due to activation of the crystal in the detector. The high energy neutron source is pulsed at a preselected rate, and the resulting capture-induced radiation is measured during a first portion of the operating cycle. Thereafter, the source is inactivated during the balance of the cycle, and a measurement is made of the radiations registering in the activated crystal.

This latter measurement is then utilized to adjust the measurements obtained during the irradiation period according to a predetermined relationship. (CA)

6151 EVALUATION OF THE ISOTOPIC METHOD FOR DETERMINING THE SURFACE MASS OF A FABRIC, WITH AN IMG-METER, DEPENDING ON ITS FIBER COMPOSITION AND MOISTURE CONTENT. Markiewicz, W.; Misztal, Z.; Malewska, M.; Spodenkiewicz, T.; Wojciechowski, A.; Leonowicz, L.; Mader, K. Pr. Inst. Wlokien., Lodz; 22: 143-157(1973). (In Polish).

The isotopic method for measuring the surface mass of fabrics by means of IMG meters was verified in relation to wool, cotton, and blend fabrics, at different relative humidities of the air. The surface mass of fabrics was measured using IMG meters with scales of 20 to 300 g/m^2 and 50 to 1,100 g/cm^2. The measured fabrics had been conditioned at 12%, 65%, and 90% relative humidity. Evaluation was made of the effect of the raw material and moisture content of the fabrics on the accuracy of the isotopic method with regard to the two measurement scales of the meter. The measurement results are presented graphically. Calibration curves were calculated and raw material tables for reading the surface mass are prepared. It is asserted that meters with the scale 50 to 1,000 g/cm^2 were more suitable for determining the surface mass of fabrics. (auth)

6152 IN-SITU SEDIMENT COMPOSITION MEASUREMENT USING SCATTERED GAMMA RADIATION. Maus, L. D. Kingston, RI; Univ. of Rhode Island (1974). 219p. University Microfilms Order No. 74-24,692.

Thesis (Ph. D.).

A semi-empirical mathematical model was developed to predict the response of in-situ gamma-scattering gages to changes in sediment chemical composition and density. The composition parameter measured is the "equivalent atomic number" (Z_{eq}) which is an index of the heavy-element content of the sediment. This model is unique in its applicability to the range of densities and gage characteristics appropriate to sediments. It is, however, consistent with the models of other researchers for the conditions under which their research was conducted. An extensive experimental program was conducted to obtain numerical values for the model parameters as a function of several important gage design variables. The design variables investigated were: source and detector collimation, source-detector separation, and the range of photon energies registered by the detector. The principle of similitude was used to great advantage in the experimental program. It allowed the use of water with small amounts of barium chloride to simulate a wide range of sediment densities and chemical compositions. In addition, a method was developed for modifying photon energy spectra obtained using pure water as the scattering medium to accurately simulate the spectra in media with higher Z_{eq} values. This method greatly reduced the amount of spectral distortion introduced by the sodium iodide detector. It was concluded that the mathematical model and numerical model parameters could reliably be used to predict the response of a gamma-backscatter gage to the density and composition of marine sediments. It was found that the Z_{eq}-response of a practical gage could not be made completely independent of sediment density; however, proper choice of collimation and detected energies was found to greatly reduce density effects. (Diss. Abstr. Int., B)

6153 SCIENTIFIC AND TECHNICAL SOLUTIONS IN THE THEORY AND PRACTICE OF FIELD RADIOMETRY OF HUMIDITY AND DENSITY OF SOIL-GROUNDS. Emel'yanov, V. A. pp 171-177 of Isotope and Nuclear Radiation Application in Agriculture. Section 2. Isotope Application in Crop Science and Agriculture. Moscow; Atomizdat (1971). (In Russian).

From all-union scientific-technical conference "20 years of production and isotope and nuclear radiation application in national economy of the USSR"; Minsk, USSR (7 Oct 1968). 27 refs.

Examples are given of the use of moisture and density meters, indicating the very broad range of their methodology and high technico-economic indexes. A number of theoretical and practical neutron and gamma method problems were solved. Interpretation of the results showed that routine use of this equipment decreases the time expenditure 5- to 10-fold and significantly increases the value of the measurements compared to thermostat-weight and volume-weight methods of determining moisture and density of soils. Based on theoretical analysis of physical bases of neutron and gamma methods and on detailed studies of the techniques used, a classification of the basic characteristics of neutron moisture meters and gamma density meters is set up. (tr-auth)

6154 MINIATURE ALPHA-RELAY. Karasik, A. S.; Shein, S. A. (Permskij Gosudarstvennyj Univ. (USSR)). Izotopy SSSR; No. 30, 29-31(1973). (In Russian).

The miniature alpha relay, assembled from semiconductor elements and the SBT-9 Geiger counter, is described. The relay can be used for the contactless control of breaks in thin-filmed materials, papers, fibers, or metals having a surface density of 1 to 10 mg/cm^2. (tr-auth)

6155 REDUCING THE HETEROGENEITY EFFECT OF REINFORCED CONCRETE IN DETERMINATION OF ITS DENSITY IN THIN-WALLED STRUCTURES BY A SURFACE GAMMA-DENSIMETER. Pavlov, L. A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Gidrotekhniki i Melioratsii, Moscow (USSR)). Izotopy SSSR; No. 30, 17-20(1973). (In Russian).

Recommendations were made for the reduction of the effect of the inhomogeneity of concrete and some construction characteristics of iron–concrete elements by determination of the concrete density with a surface γ densimeter. The results of the application of these recommendations under field conditions are reported. (tr-auth)

6156 THICKNESS AND DENSITY DETERMINATION BY MEASURING THE ABSORPTION OF X AND LOW ENERGY GAMMA RAYS. Daddi, L. Automaz. Strum.; 21: No. 2, 76-79 (1973). (In Italian).

The absorption of x- and gamma-rays can be utilized in nondestructive determination of thickness and density of low atomic number materials, and in industrial process control. A general treatment of the method and a review of the different radiation sources and of the utilizable instruments are presented. (INIS)

6157 METHOD OF EXTENDING THE LIFE OF NUCLEAR RADIATION SOURCES IN CONTROL AND MEASURING DEVICES. Pankratov, V. I. Meas. Tech. (USSR) (Engl. Transl.); 17: No. 4, 618(Apr 1974).

Translated from Izmer. Tekh.; 17: No. 4, 82(Apr 1974).

A method of resetting the electrometer in the detector circuit of a radiometric gage for recalibration to allow further use of the radioisotope source after appreciable reduction of the source activity is outlined. (WHK)

6158 METHOD FOR MONITORING X RADIATION. Kravchuk, E. M.; Strashkevich, E. A. (Inst. of Solid-State Physics, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 2, 572-573(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 2, 231-233(1974).

A method is proposed for monitoring x radiation which is used for absorptiometric determination of local moisture content in a porous body. (auth)

6159 ELECTRON CAPTURE DETECTION. Burgett, C. A. Res./Develop.; 25: No. 11, 28-32; 34; 36(Nov 1974).

The development of electron-capture detectors, theory of operation, and recommended radioactive sources and carrier gas mixtures are discussed. (25 references) (WHK)

6160 IONIZATION SMOKE DETECTOR. Andersson, I. (to Bevaknings AB Securitas). US Patent 3,838,283. 24 Sep 1974. Priority Date 20 Oct 1971, Sweden. 4p.

An ionization smoke detector having an open and a closed chamber which are interconnected by a thin metallic membrane, constituting a common electrode is described. The membrane is urged against the periphery of an opening between the chambers by means provided on a removable cover defining the open chamber. A single source of radiation is provided in the closed chamber. (5 Claims, 8 Drawing Figures) (Official Gazette)

6161 IONIZATION SYSTEM FOR SENSING AND MEASURING GASEOUS IMPURITIES. Harris, W. A.; Schluter, B. C.; Tromborg, E. T. (to Secretary of the Air Force). US Patent 3,835,328. 10 Sep 1974. Filed Date 12 May 1972. 4p.

An ionization detector in which a vapor sample flows past a source of ionizing radiation of beta particles and through a recombination region which forces the sample to pass through a tortuous path created by a series of parallel adjacent and spaced insulated washers mounted about a shaft with the washers having different selected openings is described. The sample first passes through a metallic manifold also having openings and then through the washers followed by the ion collection region which includes a screen of electrically conducting material. A DC voltage source connects the manifold and the screen with an ammeter in series therewith for readout. (3 Claims, 7 Drawing Figures) (Official Gazette)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstracts 6753, 6754, and 7443.

6162 (AD-777054) GEISHA SEMICONDUCTOR RELIABILITY STUDIES. A Portion of Chair-Geisha. Final Report, 1 February 1970-31 December 1971. Szedon, J. R.; Yu, K. K. (Westinghouse Research Labs., Pittsburgh, Pa. (USA)). 26 Oct 1973. Contract N00014-70-C-0230. 104p. NTIS $8.25.

The final report describes studies relating to silicon junction diodes to be used for amplifying the current in an electron beam via electron-hole pair production in silicon. Radiation damage effects on the junction reverse leakage are treated in terms of insulator charging effects. Electrical comparisons of shallow diffused and ion implanted junctions are given. Contributions to the thermal impedance of a device of the silicon, gold and beryllium component regions are assessed. Technology is described for producing targets with linear arrays of diodes from a monolithic string of elements formed in silicon. (auth)

6163 (AD-779666) PULSE POWER STUDIES OF HARDENED MICROCIRCUITS. Final Report, November 1971 - May 1973. Kennan, W. F.; Smith, D. M. (Texas Instruments, Inc., Dallas (USA)). Dec 1973. Contract F30602-72-C-0077. 83p. (TI-03-73-57; RADC-TR-73-367). NTIS $4.00.

A study was made of the effects of large amplitude transient pulses on radiation tolerant integrated circuits. Two distinct burnout mechanisms exist, diode failure and resistor burnout. Both mechanisms were investigated independently by test structures to measure the influence of processing variations on the failure levels. (auth)

6164 (AD-780186) RADIATION EFFECTS OF MOS GATE INSULATORS. Final Report, July-December 1973. Fowkes, F. M.; Kahlke, W. E.; Butler, S. R. (Lehigh Univ., Bethlehem, Pa. (USA)). Jan 1974. Contract DAAG39-73-C-0200. 45p. (HDL-TR-200-1). NTIS $3.25.

Impurity metal ions (sodium, aluminum, chromium, and gold) were diffused (and grown) into oxide films on silicon which were then exposed to 1,000,000 rads of ionizing radiation from a cobalt-60 source. The effects of radiation were observed by chemical analysis (to determine ion transport) and by conductance and capacitance measurements (to determine oxide charge and distribution of surface state density). (auth)

6165 (AD-780521) ELECTRON BEAM INDUCED DEGRADATION IN EBS DIODES. Krag, W. E. (Massachusetts Inst. of Tech., Lexington (USA). Lincoln Lab.). 20 May 1974. Contract F19628-73-C-0002. 58p. (ESD-TR-74-210). NTIS $3.75.

The report describes the effects of ionizing radiation on oxide-semiconductor structures and, in particular, the effects of electron beams on the characteristics of EBS devices. Several methods of protecting the EBS diodes from the effects of the high energy electron beam are proposed and discussed. Brief mention is made of some experiments which have been performed. (auth)

6166 (AD-782285) TRANSIENT SURFACE DAMAGE. Final Technical Report, 1 December 1972-31 December 1973. Simons, M. (Research Triangle Inst., Durham, N. C. (USA)). Jan 1974. Contract N00014-73-C-0236. 93p. (RTI-43U-812-FR). NTIS $7.75.

The report describes the results of a study of transient surface damage phenomena in contemporary MOS and CMOS devices following pulsed radiation exposure. Measurements made on individual n- and p-channel transistor structures between 0.0001 sec and 1000 sec after irradiation show that there are widespread variations in radiation sensitivity and space charge annealing behavior among samples prepared by different processes and by different manufacturers. Response data for devices fabricated on bulk silicon and silicon-on-sapphire (SOS) substrates and for various SiO_2 and Al_2O_3 gate insulators are compared and discussed. The effects of radiation-induced charge in the sapphire substrate of an SOS device are explored. (auth)

6167 (AED-CONF-74-089-047) EFFECT OF IONIZING RADIATION ON CURRENT TRANSPORT THROUGH THE CHANNEL OF A MOS-FIELD EFFECT-TRANSISTOR. Baeuerlein, R. (Siemens A. G., Erlangen (F. R. Germany). Forschungslaboratorium). 1974. 6p. (In German). INIS.

From spring meeting of the Arbeitskreis Festkoerperohysik of the Deutsche Physikalische Gesellschaft; Freudenstadt, F. R. Germany (1 Apr 1974).

7 figs.

During an ionizing irradiation, a positive space charge occurs in the silicon oxide insulating layer, through which the shielding factor of the gate voltage is reduced and furthermore, defect centers on the Si/SiO_2 boundary surfaces are activated which can capture and scatter free charge carriers. To investigate the thus connecting phenomena, a MOS structure on N conducting substrate was chosen with a 400μm long and 40 μm wide channel. 35 keV electrons were used for irradiation which on the one hand possess a sufficient range in the MOS structure (about 10 μm), on the other hand however, are not in the position to produce lattice defects. (GE)

6168 (NASA-CR-780160) THEORETICAL AND EXPERIMENTAL STUDIES OF SEMICONDUCTOR DEVICE DEGRADATION DUE TO HIGH POWER ELECTRICAL TRANSIENTS. Final Technical Report, 6 March 1972-31 December 1973. Tasca, D. M.; Peden, J. C.; Andrews, J. L. (General Electric Co., Philadelphia, Pa. (USA). Space Div.). Dec 1973. Contract DAAG39-72-C-0066. 129p. NTIS $4.75.

The report presents the results of a study to determine the modes and mechanisms of semiconductor component degradation and failure resulting from high electrical stress transient inputs. Principal areas of investigation were the detailed characterization of such degradation and failure mechanisms in selected discrete, bipolar and unipolar devices and integrated circuits when stressed with high current transients in the nanosecond to microsecond time regime and to investigate the correlation of component failure with nondestructive parameter measurements. A major area of interest was to experimentally show the utility of square wave pulsed-power damage testing in the prediction of semiconductor device response for complex power waveforms typical of electromagnetic pulse (EMP) induced transients, and to develop basic analytical techniques for prediction of complex power waveform response using square wave response data. (GRA)

6169 (ORNL-4979, pp 79-82) EFFECTS OF ELECTROMAGNETIC PULSE (EMP) FROM HIGH-ALTITUDE DETONATIONS. Barnes, P. R.; Marable, J. H.; Nelson, D. B.; Ragan, G. L. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Topics include EMP transmission through underground cables, a versatile pulser for proof-testing EMP hardness by pulse injection, response of an infinitely long perfectly conducting cylindrical antenna to an electromagnetic plane wave pulse, and transient response of low-frequency vertical antennas to high-altitude nuclear electromagnetic pulses. (WHK)

6170 (SAND-74-0300) RADIATION EVALUATION OF 512-BIT PROM'S IN GAMMA DOSE, GAMMA RATE, AND NEUTRON DOSE ENVIRONMENTS. Barnum, J. H. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 63p. Dep. NTIS $6.25.

The response characteristics of 512-bit bipolar PROM's (programmable read-only memories) in gamma dose, gamma rate, and neutron environments are described. Also described are the facilities used and the criteria on which the test sequence was based. Upset of a logical "0" at rates in the range of 5×10^7 to 1×10^8 rads/sec was detected, while upset of a logical "1" was detected at rates from 3×10^8 to 9×10^8 rads/sec. The neutron environment caused catastrophic failure with an accumulated dose of about 5×10^{14} nvt. Although the gamma dose sequence produced discernible changes in attributes, no catastrophic failures occurred through an accumulated dose of 5×10^7 rads. (auth)

6171 (UCID-16009) TO HIGH POT OR NOT: A DISCUSSION ON P.I.P. IN CONNECTORS. Matthews, S. M.; Catron, H. C.; Francis, H. D. Jr.; Redhead, D. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Mar 1972. Contract W-7405-eng-48. 19p. Dep. NTIS $4.00.

Persistent internal polarization (P.I.P.) occurs when an electric field is impressed across certain dielectrics giving rise to a redistribution of charge within the dielectric material. If the field is removed after the charge redistribution occurs, the dielectric is then in a polarized state which gives rise to an internal electric field. A dielectric in such a state is said to exhibit the phenomenon of P.I.P. This condition is what occurs in a typical field connector such as the NCO-92 commonly used in vacuum Compton diodes. The dielectric material in the connector is polarized when the detector is high potted and exhibits P.I.P. after the high pot is removed. If the connector is irradiated with gammas while it is in a P.I.P. state, the polarization decays very quickly giving rise to a current pulse in the external circuit called radiation release. Experiments to measure the current pulse in a circuit due to the radiation release of P.I.P. in an NCO-92 connector commonly used on vacuum Compton diodes are described. (WHK)

6172 (UCID-16172) REPORT ON ELECTRONICS SUPPORT TO B-DIVISION PROJECT 840/02, DIAMOND SCULLS. Pence, G. A.; Noel, R.; McDonald, D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Jan 1973. Contract W-7405-eng-48. 50p. Dep. NTIS $5.50.

The Diamond Sculls experiment was conducted at the Nevada Test Site (NTS) and was detonated on July 19, 1972. Project 840/02, the Lawrence Livermore Laboratory (LLL) B-Division participation,

exposed samples for IEMP studies inside the Line-of-Sight (LOS) pipe located in T tunnel. Thirty signal cables were multiplexed onto six uphole cables in an instrumentation alcove off the cable drift, about 46 meters from the LOS pipe. The cables were then routed through a splice rack and uphole to the mesa, approximately 360 meters overhead. The signals were recorded on traveling wave oscilloscopes in a trailer on top of the mesa. In addition, a low-level system was provided to record calorimeters, bias voltage and current, to provide control, and to monitor the auxiliary vacuum system for the project. The purpose of the project was to expose flat coaxial cable, aluminum Q-cable and some dielectrics to an intense radiation environment for IEMP studies as part of the Styx experimental goals. This report details the electronic engineering support to Project 840/02 Diamond Sculls. It attempts to describe all the major hardware that was involved in putting the experiment together. Sample fabrication is detailed as well as the multiplexing system used. The planning that went on and the field coordination is discussed. (WHK)

6173 TRANSIENT IONIZING RADIATION EFFECTS IN TRAPATT DIODE OSCILLATORS. Geipel, H. J. Jr. Troy, NY; Rensselaer Polytechnic Inst. (1974). 143p. University Microfilms Order No. 74-26,075.

Thesis (Ph. D.).

The effects of transient ionizing radiation on S-band 30 watt pulsed TRAPATT diode oscillators have been evaluated. Both n-type and p-type devices were irradiated with 100 nsec pulses of 10 MeV electrons from a linear accelerator while operating in a multiple slug coaxial cavity designed for time delay triggering. As the dose rate is increased from 4×10^6 to 4×10^9 rads (Si)/sec, the rf peak power decreases gradually below a critical dose rate, and is virtually quenched during the radiation pulse above the critical value, even though the diode still operates in the TRAPATT mode. The diode recovers to its nominal performance within 50 nsec after the end of the radiation pulse, independent of the radiation pulse position with respect to the rf output pulse. The rf power, bias voltage and current, and recovery transients were identical for air-filled and evacuated cavities. A theoretical model is derived correlating the radiation-induced reverse saturation (leakage) current with the rf output power. The model includes the avalanche shock front build-up, plasma formation, plasma extraction, and a simple recovery transient. Voltage and current waveforms are obtained which reflect device physics and circuit interaction. Although this model agrees closely with experimental results below the critical dose rate, the rapid decrease in power with increasing dose rate is not predicted. It is thought that the recovery transient plays an important part in the rapid decrease in power above the critical dose rate, and experimental results without irradiation support this contention. (Diss. Abstr. Int., B)

6174 X-RAY INDUCED CURRENTS AND SPACE-CHARGE BUILDUP IN MOS CAPACITORS. Farmer, J. W. Manhattan, KS; Kansas State Univ. (1974). 109p. University Microfilms Order No. 74-25,599.

Thesis (Ph. D.).

The primary effect of ionizing radiation on the MOS structure is the buildup of positive space charge in the oxide layer. The purpose of this work was to study the results of the currents induced during x-irradiation in relation to the process of space-charge buildup. The MOS structures used in the present study were made from thermally oxidized Si wafers with either Al or Au vapor deposited electrodes. The x-rays were generated with a Cu target x-ray tube operated at 35 kV. The x-ray induced currents were studied by measuring the current versus time during the irradiation and by measuring the initial current versus electric field during irradiation. In conjunction with the photocurrent measurements, space-charge buildup, photocapacitance and photoconductive yield were measured. Initial current versus electric field measurements indicate that initially there is no significant injection of charge into the oxide from the electrodes. Photocapacitance measurements also indicate a lack of charge injection initially. Current versus time measurements, however, indicate that after sufficient space-charge buildup, injection of charge from the electrodes becomes significant. Current versus time measurements also indicate that space charge builds up more rapidly when Si is the cathode than when the metal electrode is the cathode. Attempts to describe the results of the photoconductive yield measurements in terms of the model used by R. C. Hughes to describe the yield measurements in fused silica were unsuccessful. At this time it cannot be clearly ascertained whether the failure of the model is due to slight physical differences between thermal SiO_2 and fused silica or whether an alternative theory exists which can account for all the data. (Diss. Abstr. Int., B)

6175 EMISSIVE FEATURES OF A $Y_3Al_5O_{12}$: Nd^{3+} LASER ON IRRADIATION WITH GAMMA RAYS. Bedilov, M. R.; Egamov, U. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 4, 70-71(1974). (In Russian).

The active element of the laser was irradiated with gamma rays up to a dose of 10^8 R at 50 and −196°C. A minimum in the yield of stimulated emission is observed at a temperature of 50°C and a radiation dose of 10^6 R. The light yield can be restored by thermal annealing of the color centers induced in the laser element by gamma irradiation. (SJR)

6176 ROLE OF RADIATION DAMAGE ON THE CONTACT RESISTANCE OF GaAs SCHOTTKY BARRIERS. Taylor, P. D.; Morgan, D. V. (Univ. of Leeds, Eng.). Electron. Lett.; 10: No. 21, 428-429(17 Oct 1974).

The effects of radiation damage on the current/voltage characteristics of Ni-GaAs Schottky barriers are studied. Boron ions implanted into the semiconductor are shown to reduce the device contact resistance. The nature of the defect levels so introduced is studied by thermally stimulated current and capacitance measurements. (auth)

6177 EVALUATION OF RADIATION DAMAGED EPITAXIAL SILICON. Colclaser, R. A.; Southward, H. D.; Baca, J. P. (Univ. of New Mexico, Albuquerque). Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1232-1235(Sep 1974).

A technique has been developed for the determination of the concentration and Hall mobility of majority carriers in n on p homoepitaxial silicon using micro-Hall samples. These devices are essentially the same size as monolithic integrated circuits, and, since junction isolated integrated circuit processes are used in the manufacture of these samples, they have the properties of as-processed integrated-circuit materials. After initial characterization, the samples were exposed to pulse reactor spectrum neutron fluences at room temperature. Subsequent characterization permitted the determination of majority carrier removal rates and mobility degradation. As expected, the carrier removal rate for epitaxial silicon at the onset of electrically observable displacement damage is essentially the same as that for bulk silicon with the same resistivity, 2.65 $neutrons^{-1}\ cm^{-1}$. Mobility degradation is not significant at room temperature. Low-temperature characterization indicates the importance of damage clusters on mobility when charge scattering dominates over lattice scattering. (auth)

6178 EFFECTS OF IONIZING RADIATION ON THIN-OXIDE (20 TO 1500 A) MOS CAPACITORS. Share, S.; Epstein, A. S. (Harry Diamond Labs., Washington, DC). J. Appl. Phys.; 45: No. 11, 4894-4898(Nov 1974).

Metal-oxide-semiconductor capacitors with SiO_2 oxides ranging from 20 to 1500 Å thick were exposed to a ^{60}Co γ radiation dose of 10^6 rad(Si). Both p- and n-type substrates and Al- and Au-metal electrodes were used. For devices with oxides less than 100 Å thick, little or no parallel shift, no increased distortion, and no increased dispersion as a result of irradiation were observed in the C-V characteristic, indicating negligible buildup of oxide charge and negligible change in the interface density upon irradiation. For oxides thicker than 100 Å, the oxide-charge buildup increased greatly with thickness in the p-type devices, whereas in the n-type devices the oxide-charge buildup was comparable to the thin-oxide value. Interpretation of the p-type Al-metal electrode devices for oxides thicker than 100 Å are consistent with $10^{18}\ cm^{-3}$ hole traps residing in the oxide. However, for oxides thinner than 100 Å, a larger value of oxide-charge buildup is predicted in these p-type Al-metal electrode devices than observed. Differences in oxide-charge buildup between p- and n-type Al-metal electrode thick-oxide devices can be understood qualitatively by metal-semiconductor work-function differences. (auth)

6179 PROBLEMS IN THE ANALYSIS OF SEMICONDUCTOR DEVICE MATERIALS EXPOSED TO IONIZING RADIATION. Schmidt, P. F. (Bell Telephone Labs., Allentown, PA); McCaughan, D. V.; Kushner, R. A. Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1220-1223(Sep 1974).

Enhanced diffusion of impurities in solids at elevated temperatures under exposure to high-energy particles is well known and is largely attributable to the generation of excess vacancies. This paper deals with the more subtle effects that can be caused by ionizing radiation (below the threshold for atomic displacements) and can occur even at or below room temperature. In recent years, enhancement of diffusion under the action of ionizing radiation has been observed both in insulators and in semiconductors of the diamond lattice type. It has become evident that analytical results obtained by techniques using strongly ionizing radiation (for instance, electron or ion microprobes), or obtained on samples exposed to ionizing radiation beforehand (as in neutron activation work) can be very misleading if the possible alteration of the diffusion profile by the ionizing radiation is not taken into account. Another source of error in neutron activation work is the transfer

of impurities from the container material itself to the sample surface, followed by radiation enhanced diffusion into the sample. An attempt is made to give a brief survey of the enhancement effects due to ionizing radiation reported in the literature so far, as well as of the explanations proposed for these effects. Some recent work by the authors is also included. (auth)

6180 DEGRADATION OF OXIDE FILMS DUE TO RADIATION EFFECTS IN EXPOSURE TO PLASMAS IN SPUTTER DEPOSITION AND BACKSPUTTERING. McCaughan, D. V.; Kushner, R. A. (Bell Telephone Labs., Murray Hill, NJ). Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1236-1241(Sep 1974).

The particle bombardment and other effects occurring in plasma systems used to process semiconductor devices are described and characterized, in particular in the dc and RF diode and dc triode systems commonly used for processing. DC diode systems and RF diode systems are shown to cause degradation in processed devices due to energetic particle bombardment, as do dc triode systems. In triode systems magnetic field protection is of assistance; in dc and RF diodes, grid systems may be necessary. Since the degradation of processed devices is often not annealable, some protection of devices from degradation during processing may be essential. (auth)

6181 RADIATION EFFECTS IN TRANSIT-TIME MICROWAVE DIODES. Gutmann, R. J.; Borrego, J. M.; Ghandhi, S. K. (Rensselaer Polytechnic Inst., Troy, NY). Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1256-1264(Sep 1974).

There has been considerable progress in the direct generation of microwave power using two-terminal semiconductor devices during the last decade. Permanent and transient radiation effects on bulk (Gunn and LSA) and junction (IMPATT, TRAPATT, and BARITT) transit-time microwave diodes are reviewed. Emphasis is placed upon relating the primary effects of radiation to the physics of device operation. The principal permanent damage is attributed to carrier removal effects, impairing the RF performance of bulk diodes below 10^{14} neutrons/cm^2 and junction transit-time diodes at fluences near 10^{15} neutrons/cm^2. The principal transient effect is the generation of free carriers by ionizing radiation, affecting the RF performance of bulk diodes above 10^9 rad/s and junction transit-time diodes at dose rates near 10^8 rad/s. (53 references) (auth)

6182 RADIATION EFFECTS ON SEMICONDUCTOR DEVICES. Gregory, B. L.; Gwyn, C. W. (Sandia Labs., Albuquerque, NM). Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1264-1273(Sep 1974).

The radiation-induced degradation of semiconductor material parameters is reviewed. These results are related to the degradation of semiconductor-device performance. Design techniques for minimizing the radiation-induced degradation are evaluated. Emphasis is placed on the effects of neutron-produced displacement damage on devices and on the effects of ionizing radiation on MOS structures. Transient ionization effects and circuit latchup are considered. The present degree of understanding of radiation effects in silicon devices is summarized. (42 references) (auth)

6183 DEPENDENCE OF IONIZING RADIATION INDUCED h_{FE} DEGRADATION OF EMITTER PERIPHERY. Pease, R. L. (Naval Ammunition Depot, Crane, IN); Coppage, F. N.; Graham, E. D. IEEE (Inst. Elec. Electron. Eng.), Trans. Nucl. Sci.; NS-21: No. 2, 41-42(Apr 1974).

The experimental data that has been accumulated on ionizing radiation damage in semiconductor-insulator systems indicates that the amount of damage depends on the type, impurity content and initial interface state density of the insulator as well as the crystal orientation and dislocation density of the semiconductor. In addition, for bipolar transistors the amount of h_{FE} degradation is dependent on the current density and the length of the emitter periphery. Devices which differ only in emitter periphery were subjected to ionizing radiation to investigate the influence of emitter periphery on h_{FE} degradation. The data indicate that, within reasonable limits, the increase in base current from ionizing radiation is directly proportional to the length of the emitter periphery. However, differences in fabrication techniques, passivation materials and processing, and silicon crystal orientation may very well have a greater influence on the degradation from ionizing radiation than the emitter periphery. (WHK)

6184 SIMULATION FOR RADIATION EFFECTS IN ELECTRONICS. Van Lint, V. A. J. Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1190-1195(Sep 1974).

Adequate simulation testing for radiation effects requires knowledge of radiation effects mechanisms to relate test environments to operational environments. In order to scale the effect with radiation type, spectrum, or time dependence, the response must be separated into different radiation effects. The basic separation is into displacement, charge-transfer, and ionization effects. Within each category short-lived and long-term responses must be considered. Specific simulation facilities can be used to produce particular combinations of effects. Pulsed and steady-state neutron sources (reactor or accelerators), flash X-ray machines, and electron linear accelerators are particularly useful for producing the effects of the radiation from a nuclear explosion. Steady-state electron and proton accelerators are especially appropriate for simulating space radiation. In the first case the problem is to produce the high radiation rates; in the second to qualify accelerated testing. Many other simulation problems fall between these two limits. (auth)

6185 PHOTON-INDUCED CHARGE TRANSFER AND SURFACE EMISSION. Barlett, R. H. (Univ. of California, Livermore); Fulk, G. A.; Hofer, W. W.; Meeker, D. J.; Lee, R. S.; Weingart, R. C. Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1215-1220(Sep 1974).

Experimental measurements have been made of photon-induced charge transfer between plane-parallel electrodes. X-rays from a pulsed X-ray source were directed at near-normal incidence onto plane-parallel electrodes, and the current which flowed between the electrodes during the X-ray pulse was measured. Quantities obtained include bulk charge transfer in several dielectric materials; forward and reverse electron emission from Al, Cu, and Au surfaces; and secondary electron emission coefficients for these metals and selected dielectrics. Measured values for charge transfer and surface emission are compared with calculations. (auth)

Miscellaneous Instruments

Refer also to abstract 6725.

6186 (AED-CONF-74-098-002) COMPUTER CONTROLLED BACK SCATTERING MEASUREMENTS WITH LIGHT IONS USING THE CAMAC SYSTEM WITH DVA 301. Kubitz, M. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany)). 1974. 12p. (In German). INIS.

From fifth annual meeting of the users group 1 of Siemens process computers in the Physikalisch-Technische Bundesanstalt; Braunschweig, F. R. Germany (2 Apr 1974).

3 figs.; 9 refs. With abstract.

A computer-controlled backscattering experiment with light ions using the DVA 301 is described. The test assembly is explained and the application of the CAMAC system to control the stepping motors and to supervise the experiment is also presented. A modular software system for the controlling of the experiment and for the collecting and processing of the raw data is introduced. (GE)

6187 (JAERI-M-5657) ANALYSIS OF THE CPU IDLE TIME OF COMPUTER FACOM 230-60. Ishiguro, M.; Yamada, T. (Japan Atomic Energy Research Inst., Tokyo). Apr 1974. 49p. (In Japanese). NTIS (U. S. Sales Only).

CPU idle was measured and analyzed to examine the CPU utilization of JAERI computer systems. The CPU utilization is described in detail, dividing it in four states: (1) user CPU time, (2) system overhead, (3) I/O wait time, and (4) idle time. The CPU idle time is seen to be about 35%. To find out the causes of CPU idle, the concerned data are gathered by software measurement and accounting information. And a series of events in the computer system are statistically analyzed by the regression method. Hardware measurement is also attempted to count the device utility by connecting the scalers to the computer devices frequently used. Many figures and tables are given to facilitate the review of computer usage in JAERI. (auth)

6188 (JAERI-M-5659) USAGE OF THE GRAPHIC DISPLAY AND VARIOUS GRAPHIC PROGRAMS. Nakamura, Y.; Onuma, Y.; Kobayashi, K.; Suzuki, T. (Japan Atomic Energy Research Inst., Tokyo). Feb 1973. 40p. (In Japanese). NTIS (U. S. Sales Only).

Programs using graphic display made available have been used in the F230-35 ROS system, JAERI. Some 20 graphic programs have been developed for spectrum analysis of gamma rays, data processing of neutron cross sections, seismic simulation of reactor cores, curve fitting of experimental data, etc. With the executable program tapes prepared for the respective programs, they can immediately be put to practical use. (auth)

6189 (JAERI-M-5739) REMOTE BATCH STATION FOR PAPER TAPE INPUT. Ishiguro, M. (Japan Atomic Energy Research Inst., Tokyo). Jun 1974. 26p. (In Japanese). NTIS (U. S. Sales Only).

A remote batch station by mini-computer, FACOM U200, installed in the computing center which is used for the processing of paper tape is described. It is a front-end machine to the large scale computer, FACOM 230-60-No. 2 system which is for processing of the paper-tape-based experimental data from pulse height analyzers in the JAERI. The operating techniques of this station, the method of code conversion, the JOB structures for data analysis and examples of the programs are described. (auth)

6190 INVESTIGATION INTO THE BETA-RADIATION SCATTERING FACTOR IN CYLINDRICAL COLLIMATORS. Tumul'kan, A. D.; Krop, V. Ya. Izotopy SSSR; No. 30, 3-6(1973). (In Russian).

Data from the investigation of the scattering coefficient of the β radiation of $^{90}Sr + ^{90}Y$ in cylindrical collimators as a function of the height h, diameter d, and atomic number Z of the material are reported. In the region $h/d < 6$ an empirically derived formula was valid for engineering calculations. The intensity of the scattered β radiation for narrow geometry with glancing angles of incidence and reflection θ was measured as a function of the atomic number of polished and ground flat samples. For materials with $Z > 60$ at $\theta = 0$ to 82° the intensity of the radiation begins to decrease. (tr-auth)

6191 MASS SPECTROMETER FOR THE ANALYSIS OF URANIUM HEXAFLUORIDE AND FLUORINE. Fujisawa, G.; Hasimoto, H.; Iwasaki, M.; Tsujimura, S. (Japan Atomic Energy Research Inst., Tokai). Shitsuryo Bunseki; 22: No. 1, 25-34 (May 1974). (In Japanese).

A mass spectrometer for the analysis of gas samples containing uranium hexafluoride and fluoride impurities was constructed by modification of the ionization chamber and gas inlet system of a Hitachi RMU-6L mass spectrometer. The treatment of the system by fluorine was effective to remove the impurities reactive for uranium hexafluoride. After flushing the system by uranium hexafluoride, a linear relationship between the UF_5^+ peak height and the pressure of uranium hexafluoride in the sample gas reservoir was obtained. (auth)

6192 FLY'S EYE: A COUNTING CAMERA FOR THERMAL NEUTRONS. Davidson, J. B. (Oak Ridge National Lab., TN). J. Appl. Crystallogr.; 7: No. 3, 356-366(1 Jun 1974).

A two-dimensional position-sensing detector for thermal neutrons was developed to improve the data collection in single-crystal neutron diffraction experiments, small-angle diffraction patterns from fibers and membranes, inelastic scattering measurements using the multiangle reflection crystal technique, nuclear and magnetic diffraction topography, and diffraction and transmission measurements on samples in which phase changes are occurring. The detector is a unique tool for rapid inspection of crystal quality, isolating grains, and alignment of a number of small crystals so that they reflect together for intensity enhancement. Simple diffraction experiments were made to illustrate the range of application. The camera consists of a neutron phosphor screen, image intensifier, television pick-up tube, and digital storage. The stored information can be displayed in one- and two-dimensional formats and transferred to magnetic tape for computer analysis. The camera resolution is 0.13 mm full width at half maximum (fwhm) horizontal and 1.0 mm vertical, which corresponds to more than 80,000 detector elements over the useful area of the nominal 150 mm diameter phosphor screen. The counting rate per detector element is 60 regularly occurring events per second. The counting efficiency is ~15% for a 0.5 mm thick phosphor. (auth)

6193 NOVEL NEUTRON MONOCHROMATOR. Schoenborn, B. P.; Caspar, D. L. D.; Kammerer, O. F. (Brookhaven National Lab., Upton, NY). J. Appl. Crystallogr.; 7: No. 5, 508-510(1 Oct 1974).

Alternating layers of two different metals such as Mn and Ge evaporated on an optical flat form a one-dimensional "crystal" which can serve as a wide wavelength band-pass neutron monochromator with a small angular divergence. Measurements of the reflectivity, which exceeds 30% at 4 Å, of such metal film multilayers are presented. (auth)

6194 USE OF A TWO-AXIS NEUTRON DIFFRACTOMETER ON AN ANGLED REACTOR CHANNEL. Haywood, B. C. G. (Atomic Energy Research Establishment, Harwell, Eng.). Acta Crystallogr., Sect. A; 30: No. 3, 448-453(1 May 1974).

The resolution function is derived for a two-axis neutron diffractometer in which the monochromator scattering plane is inclined to the specimen scattering plane. The analysis shows that useful results can be obtained from powder diffractometers which operate in the horizontal plane and are installed on reactor holes inclined by up to 35° from the horizontal. It is also shown that single-crystal diffractometers may be installed on reactor holes with angles up to 50° from the horizontal. (auth)

6195 TIME-TO-DIGIT CONVERTOR. Tlaczala, W.; Basiladze, S. G.; Smirnow, W. A. (Warsaw Polytechnical Inst.). Nukleonika; 19: No. 9, 777-783(1974). (In Russian).

A time-to-digit convertor on the START-STOP principle is presented. The time interval is converted in number of periods of start-generator and interpolation of time interval between the last counting pulse of the start-generator and the end of the time interval is executed with the modified vernier method. Minimal channel width is 110 ps. The number of channels is 2^{16}. The instrument has been completed in CAMAC standard. (auth)

6196 DIGITALLY CONTROLLED NANOSECOND DELAY BOX IN CAMAC STANDARD. Tlaczala, W.; Basiladze, S. G. (Warsaw Polytechnical Inst.). Nukleonika; 19: No. 9, 785-789 (1974). (In Russian).

A digitally controlled nanosecond delay box in the CAMAC standard is described. The delay range is 1 to 63 ns; the minimum possible delay change is 1 ns; the delay of the circuit is 20 ns; the temperature instability of the delay is 0.1%/°C; the supply instability of the delay is 1 ns/V; the delay accuracy is ±2%; and the maximum band width is 80 MHz. (auth)

6197 A MASS SPECTROMETER FOR THE ANALYSIS OF URANIUM HEXAFLUORIDE AND FLUORINE. Fujisawa, Ginji; Hasimoto, Hitoshi; Iwasaki, Matae; Tsujimura, Shigeo (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Shitsuryo Bunseki; 22: No. 1, 25-34(May 1974). (In Japanese).

A mass spectrometer for the analysis of gas samples containing uranium hexafluoride and fluoride impurities was constructed by modification of the ionization chamber and gas inlet system of a Hitachi RMU-6L mass spectrometer. The treatment of the system by fluorine was effective to remove the impurities reactive for uranium hexafluoride. After flushing the system by uranium hexafluoride, a linear relationship between the UF_5^+ peak height and the pressure of uranium hexafluoride in the sample gas reservoir was obtained. (auth)

6198 LABORATORY AND FIELD EVALUATION OF A CARBON/OXYGEN (C/O) WELL LOGGING SYSTEM. Schultz, W. E.; Smith, H. D. Jr. J. Petrol. Technol.; 26: 1103-1110(Oct 1974).

By the use of a high neutron pulsing rate of 20 kHz and a background subtraction technique, a carbon/oxygen logging system has been developed that has high counting rates (C = 700 to 1,200 counts/sec). Oil saturations can be obtained from continuous logs at 5 ft/min for porosities greater than about 15 percent. Stationary measurements can also be made if smaller statistical uncertainty is required for purposes such as determining residual oil saturations. A simultaneous calcium-to-silicon ratio has been found to be useful in identifying carbonates that might otherwise have been considered oil sands from the C/O measurements. The C/O and Ca/Si logs have been found to be almost completely independent of salinity and boron content (shaliness). The system has particular utility in cased wells having low or unknown formation salinities and might also be of use in shaly zones where neutron die-away logs are often difficult to interpret. It has been tested in laboratory formations and in 77 wells, agreeing with perforation results in 25 of 34 conclusive tests. (auth)

6199 DESIGN PRINCIPLES OF A COMPUTER SYSTEM FOR INTENSIVE CARE SITUATIONS. Hooton, I. N. (Atomic Energy Research Establishment, Harwell, Eng.). IEEE (Inst. Elec. Electron. Eng.), Trans. Nucl. Sci.; NS-21: No. 2, 33-40 (Apr 1974).

The data handling aspects of a computer system for routine use in an intensive care situation are considered. A distinction is made between the display of continuous analog signals (monitoring) and the extraction of clinical values from the signals (measurement). Data acquisition is examined, with a comparison between central multiplexing and local processing as a means of extracting clinical values. Preprocessing, data storage and main processing are discussed with an emphasis on cost reduction. Display requirements are outlined and currently available means of implementation compared. An overall design philosophy is proposed and a typical cost distribution suggested. (auth)

6200 INCLINED POSITIONING OF THE SNM-17 NEUTRON DETECTOR IN ORDER TO INCREASE THE EFFICIENCY OF A NEUTRON-DIFFRACTION INSTALLATION. Kelarev, V. V.; Zykin, M. P.; Pirogov, A. N.; Dorofeev, Yu. A.; Kozlov, A. I. (Metal-Physics Inst., Sverdlovsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 690(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 58(1974).

Positioning an SNM-17 counter at an angle ~23° with respect to the directions of the neutron beam leads to an increase in the counting efficiency by a factor of 1.8. (auth)

6201 MOLYBDENUM–RUTHENIUM THERMOCOUPLE FOR TEMPERATURE MEASUREMENTS UNDER NUCLEAR REACTION CONDITIONS. Zysk, E. D.; Robertson, A. R.; Cisz, M.; Sheridan, R. W. (to Engelhard Minerals and Chemicals Corp.). US Patent 3,836,402. 17 Sep 1974. Filed Date 28 Aug 1972. 4p.

A thermocouple suitable for use under high temperature conditions in nuclear reactors and other environments where neutron irradiation exists is described. One element of the thermocouple is composed essentially of molybdenum and the other element essentially of ruthenium. (1 Claim, 1 Drawing Figure) (Official Gazette)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Isotope Separation (Industrial)

Refer also to abstracts 5631 and 5708.

6202 (AECL-4915) COUNTER-CURRENT ELECTROMIGRATION FOR HEAVY WATER PRODUCTION: AN ASSESSMENT. Hammerli, M. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1974. 45p. Dep. NTIS (US Sales Only) $5.25. AECL $1.00.

The essential elements of an electromigration cell with self-induced counter-current flow are explained, and it is shown how such a cell may be used for the separation of isotopes. Following Roy's treatment (J. Electrochem. Soc. 120, 1044 (1973)), equations and graphs are presented for the general case of isotope production via counter-current electromigration of isotopic cations where the isotope of interest is the slower cation. Relevant column parameters for a D_2O production plant have been calculated for several cases involving different assumptions. The economics for energy requirements alone are not insurmountable if it can be demonstrated experimentally that the height of a theoretical plate is of the order of 6×10^{-3} cm and the effective elementary separation factor is of the order of 2.5. (auth)

6203 (CONF-740302-4) METEOROLOGICAL EFFECTS OF THE MECHANICAL DRAFT COOLING TOWERS OF THE OAK RIDGE GASEOUS DIFFUSION PLANT. Hanna, S. R. (National Oceanic and Atmospheric Administration, Oak Ridge, Tenn. (USA). Atmospheric Turbulence and Diffusion Lab.). Mar 1974. 26p. Dep. NTIS $4.50.

From symposium on cooling tower environment—1974; College Park, Maryland, USA (4 Mar 1974).

The mechanical draft cooling towers at the Oak Ridge Gaseous Diffusion Plant dissipate about 2000 MW of heat. Downwash occurs about 40% of the time, when wind speeds exceed about 3 m/s. An elevated cloud forms about 10% of the time. The length of the visible plume, which is typically 100 or 200 m, is satisfactorily modelled if it is assumed that the plumes from all the cells in a cooling tower bank combine. The calculation of fog concentration is complicated by the fact that the moisture is not inert but is taking part in the energy exchanges of a thermodynamic system. Calculations of drift deposition agree fairly well with observations. (auth)

6204 (GSI-73-7) GSI-WORKSHOP: PROBLEMS ASSOCIATED WITH TARGETS AND ACTIVATION EXPERIMENTS. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F. R. Germany)). Aug 1973. 244p. (In German). (CONF-730368-).

From 4th GSI workshop on the target problems and activation experiments; Wixhausen, F. R. Germany (27 Mar 1973).

Lectures held at the 4th GSI workshop (March 27-28, 1973) on the following subjects are presented: target problems (solid and gaseous targets), helium jet, rapid chemical separation processes (wet and dry), and on-line isotope separators. (GE)

6205 (LA-5761-SR) STATUS OF LASER SEPARATION OF BORON ISOTOPES, JUNE 1974. Rockwood, S. D.; Rabideau, S. W. (Los Alamos Scientific Lab., N. Mex. (USA)). Nov 1974. Contract W-7405-eng-36. 12p. Dep. NTIS $4.00.

A 14% enrichment in the ratio of $^{10}B/^{11}B$ has been achieved by selective excitation of $^{11}BCl_3$ ($^{11}B^{35}Cl_3$) with a CO_2 laser followed by preferential photodissociation of the excited state molecules. The subsequent photochemistry used O_2 as a scavenger. (auth)

6206 (LIB/Trans-533) PURELY AXIAL FLOW IN A COUNTERCURRENT AS CENTRIFUGE. Lotz, M. Translated by A. Bicevskis from Atomkernenergie; 22: No. 1, 41-45(1973). 15p. Dep. NTIS (US Sales Only) $4.00.

The flow in the rotating cylinder of a gas centrifuge is governed by the equation of continuity, the Navier–Stokes equations, the conservation of energy and the equation of state of a perfect gas. These equations are linearized with respect to the Rossby number which is the ratio of a typical flow velocity to the peripheral velocity of the cylinder. Exact solutions of the linearized equations are given which represent purely axial flow in a countercurrent gas centrifuge. The solutions constitute a two-parametric manifold, the two parameters being the product rate and the recirculating stream. (auth)

6207 (LIB/Trans-534) COMPRESSIBLE EKMAN LAYERS IN ROTATING CYLINDERS. Lotz, M. Translated by A. Bicevskis from Atomkernenergie; 22: No. 1, 46-50(1973). 15p. Dep. NTIS (US Sales Only) $4.00.

The Ekman layers of a compressible fluid in a rotating cylinder are calculated. One practical application is the flow in a gas centrifuge the top and bottom of which are kept at different temperatures. The Rossby number (the ratio of temperature difference to average temperature) is assumed to be small compared to unity. In the Ekman layers, the Prandtl boundary layer assumptions are made. Outside the Ekman layers, viscosity and heat conduction are neglected. Thus, the solution is uniformly valid in the entire flow field. The flow in a cylinder with top and bottom rotating at different speeds is also calculated. In the incompressible limit, the well-known solution of Greenspan is obtained. (auth)

6208 (LIB/Trans-535) FLOW MODEL FOR COUNTERCURRENT GAS ULTRACENTRIFUGES. Schmidt, W. Translated by W. Buykx from Atomkernenergie; 20: No. 4, 299-303(1972). 17p. Dep. NTIS (US Sales Only) $4.00.

In the types of centrifuges of interest today the countercurrent flow is generated mechanically in the waste discharge chamber. All the flow mechanisms which play a role in this process are described by suitable analytic expressions: friction at the rotor walls, drag of the waste and product discharge tube, flow through the holes in the waste and product diaphragms, the supersonic intake flow of the discharge tubes, and the laminar flow through the tubes. All these equations are combined into one method which finally consists of 9 equations. The results include the cut, the recirculating stream, the contained mass, and the heat energies due to friction. The method is shown to be a good tool for the optimum design of the geometric centrifuge data and for the interpretation of experiments. Some numerical results are given and discussed. A similar method can be developed for the type of centrifuge with external flow generation. (auth)

6209 (LIB/Trans-536) METHOD FOR CALCULATING THE SEPARATIVE POWER OF COUNTERCURRENT GAS ULTRACENTRIFUGES. Lotz, M. Translated by W. Buykx from Atomkernenergie; 20: No. 4, 304-308(1972). 18p. Dep. NTIS (US Sales Only) $4.00.

A theoretical method for calculating the distribution of the mole fraction of the light isotope in the rotating cylinder of a countercurrent gas centrifuge is described. The method starts from the partial differential equation given by Cohen and solves it by a two-strip integral method. The accuracy of the results is checked by inserting the solution into the partial differential equation. The method can handle arbitrary boundary conditions at the ends of the cylinder and in the feed plans. Some comparisons with experimental results are given. However, calculated flow fields must be used as input to the method, since they cannot be determined experimentally. (auth)

6210 AVAILABILITY AND GENERAL USES OF ENRICHED STABLE ISOTOPES. Eck, C. F.; Schwind, R. A. (Monsanto Research Corporation, Miamisburg, OH). Trans. Amer. Nucl. Soc.; 19: 68(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6211 URANIUM ENRICHMENT USING PLASMA CENTRIFUGES. Sabri, Z. A. (Iowa State Univ., Ames). Trans. Amer. Nucl. Soc.; 19: 230(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6212 APPARATUS AND METHOD FOR MAGNETOPLASMADYNAMIC ISOTOPE SEPARATION. Roehling, D. J.; Fradkin, D. B. (to United States Atomic Energy Commission). US Patent 3,845,300. 29 Oct 1974. Filed date 18 Apr 1973. 6p.

An apparatus and method are described for the separation of at least two isotopes present in a vaporized element. A vaporized element comprising at least two isotopes enters the smaller end of a diverging tubular magnetic field through an annular cathode. The vapor is ionized by an electrical discharge between the annular cathode and the annular anode. Because of the interaction of the radial component of the magnetic field, the particles accelerate to high rotational velocities. The particles are subsequently accelerated downstream by expansion in the diverging magnetic field in accordance with the principles of conservation of angular momentum and total energy. Differences in the angular momentum of the isotopes cause heavier isotopes of the element to diverge more than lighter isotopes. The isotopes therefore condense on a relatively cool receiving element at concentrations dependent on the flow distance from the center of the magnetic field. A second

embodiment comprises a magnetic bottle with a converging field downstream which provides a radial compression resulting in an additional centrifuging of the plasma prior to collection. (Official Gazette)

6213 WORLD TREND OF URANIUM ENRICHMENT. Genshiryoku Kogyo; 20: No. 2, 37-39(Feb 1974). (In Japanese).

The demand for energy in the world is increasing rapidly; accordingly, the expectation for nuclear power is large even in resourceful countries. Of worldwide nuclear power plants, about 80% are light water reactors, for which uranium enrichment is essential. To meet the needs of enriched uranium, the installation of new enrichment plants and the expansion of existing ones are strenuously proceeding. In the efforts to ensure the stabilized supply of enriched uranium, Japan is seeking enrichment services in the United States, and in international ventures and domestic enrichment. In the effort for domestic enrichment, the national project for the enrichment by centrifugal process is being studied by the Power Reactor and Nuclear Fuel Development Corporation. An internationally competitive plant is designed to be completed by 1985. (JA)

Isotopic Power Sources

Refer also to abstracts 5849, 6292, and 6359.

6214 (DP-MS-74-38) PRODUCTION OF ^{60}Co FUEL FORMS. Rankin, D. T.; Smith, P. K.; McBeath, P. E.; Keski, J. R.; McDonell, W. R. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). 1974. Contract AT(07-2)-1. 18p. (CONF-740947-1). Dep. NTIS $4.00.

From American Ceramic Society meeting; Williamsburg, Virginia, USA (29 Sep 1974).

The feasibility of producing refractory ^{60}Co fuel forms for radioisotopic power applications was demonstrated. Wafers of CoO, $Co_{0.5}Mg_{0.5}O$, and $CoAl_2O_4$ were fabricated to ~90% density by conventional processes and then irradiated. Activities up to 700 Ci/g Co were obtained. Wafers of each oxide can be directly encapsulated without reprocessing. (auth)

6215 (DPST-74-128-10) ^{238}Pu FUEL FORM PROCESSES. Savannah River Laboratory Monthly Report. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Oct 1974. Contract AT(07-2)-1. 18p. Dep. NTIS $4.00.

1200 g of CeO_2 shards for simulant testing of the PuFF hot press was produced. Techniques used at Mound Laboratory for welding PISA's are reviewed. Unsintered fines can be recycled directly to the cold pressing step in the production of shards for the heat source for the Milliwatt Thermoelectric Generator. (auth)

6216 (LA-5782-MS) SNAP 19/VIKING RTG SOLID PROPELLANT FIRE TEST. Snow, E. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 12p. Dep. NTIS $4.00.

On May 29, 1974, a simulant SNAP 19/Viking RTG was preheated to 121°C (250°F) and placed 152 mm from the ignited surface of a 0.9 m (3 ft) cube of UTP-3001 solid propellant. After the 10 min burn, all that remained of the RTG was the heat source. However, the aeroshell and fuel capsule were intact, with only some hairline cracks appearing in the outermost part of the clad on the ends of the fuel capsule. (auth)

6217 INTERACTION OF $^{238}PuO_2$ HEAT SOURCES WITH SIMULATED TERRESTRIAL ENVIRONMENTS. Patterson, J. H.; Matlack, G. M.; Nelson, G. B. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 33-34(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6218 DEVELOPMENT OF IRIDIUM-BASE ALLOYS FOR SPACE ISOTOPIC HEAT SOURCES. Liu, C. T.; Inouye, H. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 36(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6219 IRIDIUM HARDWARE FABRICATION FOR THE MHW HEAT SOURCE. Wyder, W. C. (Monsanto Research Corp., Miamisburg, OH). Trans. Amer. Nucl. Soc.; 19: 36-37(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6220 DEVELOPMENT OF A RADIOISOTOPE HEAT SOURCE FOR AN ARTIFICIAL HEART DEVICE. Bell, J. M. (TRW Systems Group, Inc., Redondo Beach, CA); Lurie, H.; Holman, W. S. Trans. Amer. Nucl. Soc.; 19: 37-38(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6221 PLUTONIUM-238 DIOXIDE/T-111 COMPATIBILITY STUDIES. Jones, G. J. (Sandia Labs., Albuquerque, NM); Teaney, P. E. (Monsanto Research Corp., Miamisburg, OH). Trans. Amer. Nucl. Soc.; 19: 38(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6222 COMPATIBILITY OF $^{244}Cm_2O_3$ WITH POTENTIAL RADIOISOTOPIC GENERATOR MATERIALS AT 900, 1100, AND 1400°C. DiStefano, J. R. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 39(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6223 FABRICATION PARAMETERS THAT AFFECT OPERATIONAL PROPERTIES OF $^{238}PuO_2$ RADIOISOTOPIC FUELS. Keenan, T. K.; Kent, R. A.; Zocher, R. W. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 123(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6224 APPLICATION OF RADIOISOTOPE BATTERY IN BIOMEDICAL ENGINEERING. Hori, M.; Imai, T. (Tokyo Women's Medical Coll.). Radioisotopes (Tokyo); 22: No. 9, 525-533(Sep 1973). (In Japanese).

The cardiac pacemaker is described and problems related to pacemaker implantation effects on patients and to the use of conventional and radioisotope-fueled batteries for implantable pacemakers are discussed. ^{238}Pu, ^{147}Pm, and ^{3}H are considered as the battery heat sources. Finally, the artificial heart is discussed. (JA)

Radiation Sources

Refer also to abstract 7450.

6225 MULTI-CHAMBER ISOTOPE RKhM-γ-20 GAMMA-IRRADIATION PLANT FOR RADIATION INVESTIGATIONS. Kaushanskij, D. A. (Moskovskij Inst. Neftekhimicheskoj i Gazovoj Promyshlennosti (USSR)). Izotopy SSSR; No. 90, 33-36(1973). (In Russian).

The requirements on the mass produced experimental γ installations are discussed. The circuits of the RKhM-γ-20 installation and its basic technical data are given. (tr-auth)

6226 CONCERNING THE USE OF SUPERCOMPRESSION OF MATTER BY REACTIVE PRESSURE TO OBTAIN NEUTRON PULSES. Stavisskii, Yu. A. JETP Lett. (USSR) (Engl. Transl.); 19: No. 8, 288-289(20 Apr 1974).

Translated from Zh. Eksp. Teor. Fiz., Pis'ma Red.; 19: No. 8, 548-551(20 Apr 1974).

Possible ways of generating intense neutron pulses for physical research are considered. The conditions for obtaining such pulses by the method proposed by Askar'yan et al., viz., via a chain fission reaction that develops when an intense laser beam acts on the medium, are analyzed. (auth)

Design and Fabrication

Refer also to abstract 6942.

6227 OPTIMUM DESIGN OF A SUBCRITICAL NEUTRON IRRADIATOR USING ^{252}Cf NEUTRON SOURCES. Lee, B. W.; Levine, S. H.; Jester, W. A. (Pennsylvania State Univ., University Park). Trans. Amer. Nucl. Soc.; 19: 47-48(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6228 SEALANTS FOR SOURCES EMANATING Rn-222. Bedrosian, P. H.; Sensintaffar, E. L.; Gels, G. L.; Norwood, D. L.; Culver, A. A. (Environmental Protection Board Agency, Boston). Health Phys.; 27: No. 4, 387-390(Oct 1974).

Methods are described of using gels as sealants for storing radium sources leaking radon, to prevent environmental release of radon prior to and during their disposal. The relative merits of mounting gel, with and without additions of sugar or starch and of petroleum jelly as sealants are discussed. Gels serve to form efficient radon seals which are readily adaptable to nearly any configuration of source container. They provide sealing capability unaffected by temperatures as low as 5°C, can be applied quickly and safely at remote distances from the sources, and can be easily removed for source retrieval. (UK)

Industrial Uses

Refer also to abstracts 5997 and 6270.

6229 (BARC-743) RADIATION DOSIMETRY STUDIES IN ISOMED: A COBALT-60 RADIATION STERILIZATION PLANT FOR MEDICAL PRODUCTS. Krishnamurthy, K. (Bhabha Atomic Research Centre, Bombay (India). Isotope Div.). 1974. 39p. Dep. NTIS (US Sales Only) $5.00.

A brief discussion on all pertinent aspects of dosimetry in radiation sterilization plants, with particular reference to the choice of optimum parameters for the operation of the plants is presented. The dosimetry studies carried out in Isomed, India's first radiation plant for the sterilization of medical products are described in detail. (auth)

6230 (CEA-CONF-2691) RADIOACTIVE TRACER METHOD FOR NDT OF AIRCRAFT TIRES. Boutaine, J. L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Div. de Chimie). 23 Jan 1974. 10p. (CONF-740235-1). Dep. NTIS (US Sales Only) $4.00.

From Boeing 747 structures specialists meeting; Everett, Washington, USA (26 Feb 1974).

The method uses ^{133}Xe to detect local defects in the adhesion between the tire and tread and adhesion between plies of the tire. Xenon-133 is injected into the tire with a needle and the defects are determined by measuring the local concentration of the ^{133}Xe. (TFD)

6231 DETERMINATION OF RESIDUES OF NON-IONIC TENSIDES ON COTTON. Schmitz, J. (Kernforschungszentrum Karlsruhe (F. R. Germany). Lab. fuer Isotopentechnik); Frotscher, H. Melliand Textilber. Int.; 54: No. 7, 759-761(1973). (In German).

1 fig.; 2 tabs.

The assumption was proved correct that residues of nonionic tensides are difficult or impossible to remove from cotton fiber. The proof was carried out on cotton tissue strips treated with ^{14}C-labelled fatty alcohol polyglycol ethers (corresponding running behavior with the technical non-ionic tenside in the paper chromatogram). Labelling techniques and experimental procedures are described. (GE)

6232 RADIOISOTOPE TESTS ON THE INFLUENCE OF SURFACE PROFILES ON THE WEAR AND LOAD CAPACITY OF SLIDING BEARINGS. Katzenmeier, G. Motortech. Z.; 34: No. 6, 169-175(Jun 1973). (In German).

14 figs.; 12 refs.

The continuous measurements of wear by means of radioisotopes (deuteron activation) enables the limits of the safe, non-wearing operation of sliding bearings to be very accurately determined. Wear tests on circular cylindrical bearings under static and dynamic load were carried out on a test stand. The experiments gave information on the basic running-in and wear behavior of sliding bearings. In particular, the influence of the surface roughness on the wear and load capacity was investigated. From the experimental results, relationships between the permissible smallest lubricating groove width in the bearing and characteristic surface data can be derived. (auth)

6233 RADIOISOTOPIC STUDY OF Cu-DEPOSITED Al_2O_3 POROUS PARTICLES. Mulas, P. (CIEA-IPN, Mexico City); Revilla, R. Trans. Amer. Nucl. Soc.; 19: 67(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6234 APPLICATIONS OF ^{13}C IN BIOMEDICAL RESEARCH. Matwiyoff, N. A. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 68-69(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6235 FIELD USES OF ^{15}N AS AN ISOTOPIC TRACER OF AGRICULTURAL AND ENVIRONMENTAL IMPORTANCE. Stout, P. R.; Carlton, A. B.; Hafez, A. A. R. (Univ. of California, Davis). Trans. Amer. Nucl. Soc.; 19: 69-70(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6236 STABLE ISOTOPE USE IN THE COMMERCIAL PRODUCTION OF RADIOPHARMACEUTICALS. Lamb, J. F.; Baker, G. A.; Winchell, H. S. (Medi-Physics, Inc., Emeryville, CA). Trans. Amer. Nucl. Soc.; 19: 70(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6237 A SUBSURFACE ELECTRIC SPARK RADIOISOTOPE INJECTOR. Zabrodin, P. I.; Chernyshev, G. I.; Pavlov, V. N.; Pruslin, Ya. A. (Vsesoyuznyj Nauchno-Issledovatel'skij Neftegazovyj Inst. Moscow (USSR)). Izotopy SSSR; No. 30, 25-29(1973). (In Russian).

An electric spark radioisotope injector, designed for the study of the technical condition of boreholes, is described. Bench and field tests of the injector on petroleum deposits of Belorussia showed that the electric spark method for the introduction of tracers in boreholes has significant advantages over the method of introduction of liquid tracers. (tr-auth)

6238 LEGAL ASPECTS OF RADIATION STERILIZATION. Rangnekar, M. K. (Food and Drugs Administration, Bombay (India)). pp 149-160 of Radiation Sterilization of Medical Products. Report on the Colloquium Held at Bhabha Atomic Research Centre on August 17-18, 1973. Bombay; Bhabha Atomic Research Centre (1973).

From colloquium on radiation sterilization of medical products; Bombay, India (17 Aug 1973).

Various methods of sterilization of medical products and their limitations are briefly stated. Of all the processes mentioned, radiation sterilization is found to satisfy all the criteria required such as unhindered penetrability through most of the products of medical interest, etc. The guiding policies in relation to premises for sterilization, personnel, materials, production and quality of medical products, storage, handling and labelling are given. (GP)

6239 RADIATION STERILIZATION PROGRAMME IN INDIA. Iya, V. K. (Bhabha Atomic Research Centre, Bombay (India). ISOMED). pp 15-26 of Radiation Sterilization of Medical Products. Report on the Colloquium Held at Bhabha Atomic Research Centre on August 17-18, 1973. Bombay; Bhabha Atomic Research Centre (1973).

From colloquium on radiation sterilization of medical products; Bombay, India (17 Aug 1973).

The reason for deciding to set up a radiosterilization plant for medical products in India and the present outlook for the radiation sterilization program in the country are discussed. Various methods of sterilization are compared taking into consideration the factors essential for reliability. The main advantages of radiation over the other methods of sterilization are stated briefly. Some of the special features of the large-scale sterilization plant that is being set up at Bhabha Atomic Research Centre, India, and the market survey carried out before setting up the plant are reported. Code of practice and the pricing policy are discussed. (INIS)

6240 ISOMED SERVICES. Deshpande, R. G. (Bhabha Atomic Research Centre, Bombay (India). ISOMED). pp 161-178 of Radiation Sterilization of Medical Products. Report on the Colloquium Held at Bhabha Atomic Research Centre on August 17-18, 1973. Bombay; Bhabha Atomic Research Centre (1973).

From colloquium on radiation sterilization of medical products; Bombay, India (17 Aug 1973).

The various services ISOMED offers to manufacturers of medical products and the medical profession are discussed. ISOMED plant and the important steps involved in the operation of the plant are briefly described. The significant role packaging plays in the successful application of the radiation sterilization is pointed out. Microbiology of the products subjected to radiation sterilization, product development and charges for irradiation services in the ISOMED plant are mentioned in brief. (GP)

6241 REDUCING LABOUR CONSUMPTION FOR INVESTIGATION INTO AND ATTAINING A BETTER ACCURACY IN THE DETERMINATION OF DETAILS WEAR BY MEANS OF THE SURFACE ACTIVATION METHOD. Arkhipov, V. S. (Gosudarstvennyj Vsesoyuznyj Nauchno-Issledovatel'skij Tekhnologicheskij Inst. Remonta i Ehkspluatatsii Mashinno-Traktornogo Parka, Moscow (URRR)). Izotopy SSSR; No. 30, 6-10(1973). (In Russian).

It was shown that by determination of the wear of machine components by the surface activation method using scintillation detectors and a circuit for the amplitude selection of pulses, it is possible to obtain universal calibration curves. This makes it possible to solve successfully questions on the automation of the mathematical processing of measurement with computers. (tr-auth)

6242 STUDY OF SURFACE HETEROGENEITY BY TRACER TECHNIQUE. 2. System of Platinized Platinum-thallium Sulfate Solution. Differential and Kinetic Isotopic Methods. Kazarinov, V. E.; Andreev, V. N. (AN SSSR, Moscow. Inst. Ehlektrokhimii). Elektrokhimiya; 10: No. 2, 205-208(Feb 1974). (In Russian).

For English translation see the journal Sov. Electrochem.

Differential and kinetic isotope methods were used in the study of the characteristics and nature of the heterogeneity of platinized

Pt. The presence of intrinsic heterogeneity of the surface of the platinized Pt, not excluding heterogeneity caused by the interaction of adsorbed particles, was established. (tr-auth)

6243 APPARATUS FOR IRRADIATION OF A MOVING PRODUCT IN AN INERT ATMOSPHERE. Troue, H. H. (to Union Carbide Corp.). South African Patent 266,121. 14 May 1973. Priority date 15 May 1972, USA. 29p.

An apparatus is described for in-line irradiation treatment of a moving product comprising: (a) a first and second tunnel of substantially uniform cross section each having an inlet end and an outlet end; (b) a treating chamber having at least one treating source mounted therein, said chamber being located intermediate to the outlet end of said first tunnel and the inlet end of the second tunnel and forming therewith a continuous enclosure; (c) an elongated gas injector channel having a first open end communicating with said enclosure and located from the inlet end of said first tunnel a distance equal to at least about ten times the smallest cross-sectional dimension of said first tunnel, said first open end having a length at least substantially equal to the width of said product with the longer axis of said opening directed substantially parallel to the width of said first tunnel; (d) a plenum chamber connected to a second open end of said channel; and (e) a source of inert gas for continuously introducing inert gas into said plenum chamber. (INIS)

LIFE SCIENCES

6244 (ORNL-4993) BIOLOGY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1974. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 233p. Dep. NTIS $7.60.

Brief summaries of research activities and abstracts of published papers that report the results of studies for the year ending June 30, 1974, in the fields of biochemistry, biophysics, cell physiology, genetics and developmental biology, mammalian genetics, pathology and immunology, and carcinogenesis are presented. (CH)

Radiation Effects on Biochemicals

6245 EFFECT OF IONIZING RADIATION DOSE ON STABILITY OF FATS. Salkova, Z. Bull. Slov. Pol'nohospod. Akad., Vysk. Ustavu Potravin.; 12: No. 2, 3-11(1973). (In Slovak).

In a study into the effect of ionizing radiations on the formation of oxidation products in fats, methyl linoleate, sunflower oil, and pork fat were exposed to doses of 0.1 to 4.0 Mrad of gamma radiation. The irradiation resulted in an increase in the amount of peroxides, carbonyl compounds, and conjugated dienes. Contrary to literature data, no proportionality was ascertained in the formation of the substances with the doses used. Pork fat was found to be the most radiosensitive out of the three substances. (INIS)

6246 NATURE AND MECHANISM OF THE FORMATION OF PARAMAGNETIC CENTRES IN ULTRAVIOLET-IRRADIATED PROTEINS. Sud'bina, E. I.; Azizova, O. A. (Inst. of Biological Physics, Moscow). Biophysics (USSR) (Engl. Transl.); 18: No. 6, 1062-1068(1973).

The nature and conversion of the radicals has been studied in proteins irradiated with $\lambda \sim 297$ and ~ 247 mμ at −196°C. It was found that on absorption of light by the aromatic amino acid residues, radicals formed in the proteins in regions of a protein molecule not absorbing the $\lambda \sim 297$ mμ radiation directly: the peptide group (the radicals $-CHR \cdot \overset{\overset{O}{\|}}{C}\overset{-}{O}(H^+) \cdot NH-$) and the sulphur-containing amino acid residues (the RS · radicals). The radicals of the peptide group appeared as a result of attachment of an electron to the CO group of the peptide group. The radicals $-CHR \cdot \overset{\overset{O}{\|}}{C}\overset{-}{O}(H^+) \cdot NH-$ appearing on exposure to light in the region 365 mμ broke down with rupture of the C−N bond and formation of the radicals $-CHR \cdot \overset{\overset{O}{\|}}{C}O$. In the proteins irradiated with $\lambda \sim 248$ mμ in addition to the radicals mentioned above RS · radicals were observed. The mechanism of formation and conversion of the radicals is discussed. (auth)

6247 ALTERATIONS IN SOLANUM TUBEROSUM POLYPHENOL OXIDASE ACTIVITY INDUCED BY GAMMA IRRADIATION. Pendharkar, M. B.; Nair, P. M. (Bhabha Atomic Research Center, Bombay). Phytochemistry; 13: No. 8, 1373-1377(Aug 1974).

On γ irradiation of potato tubers at sprout-inhibiting dose (10 krad), the cresolase activity showed a 45% increase while catecholase was reduced by 25%. This reduced the ratio of catecholase to cresolase from 11 to 12 in unirradiated to 5 to 6 in irradiated potatoes. Chlorogenic acid oxidation was enhanced by about 25% on irradiation. The increase in the oxidation of p-cresol corresponded with the production of diphenolic compounds. The process of activation of cresolase was slow, reversible, and oxygen dependent. A comparative study of the isoenzyme pattern suggested that this activation was due to conformational change, rather than synthesis of new protein. (auth)

Radiation Effects on Cells

Refer also to abstracts 6276, 6278, and 6283.

6248 (AD-780123) CORRELATION OF ANIMAL, CRYPT, AND STEM CELL SURVIVAL IN FISSION NEUTRON IRRADIATED MICE. A Chemical Protection Study. Annual Report. Sigdestad, C. P. (Louisville Univ., Ky. (USA)). 1 Nov 1973. Contract DADA17-72-C-2038. 42p. NTIS $3.25.

Continuing studies are reported with the antiradiation drugs WR2721, WR638, WR1607, WR2347, WR3689, WR77913, and WR109342. In addition, WR2822, WR2823, and WR168643 were added to the experimental protocol. These newly synthesized drugs were compared to the older radiation-protection compounds MEA and AET. The effects of high energy x-rays and fission neutrons were tested on intestinal crypt survival, lethality, and total cellularity. (auth)

6249 (AECL-4911) BIOLOGY AND HEALTH PHYSICS DIVISION PROGRESS REPORT, APRIL 1−JUNE 30, 1974. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1974. 62p. (PR-B-102). Dep. NTIS (US Sales Only) $6.25. AECL $1.50.

Brief summaries are presented of research projects at AECL during the period from April through June 1974. Results are reported from studies on the effects of uv radiation on DNA in cultured L cells; the population dynamics of rats exposed to several carcinogens; the possible utilization of waste heat in aquatic ecosystems, in which the effect on the growth rate of young bass (micropterus salmoides) was measured; and calculations of the neutron spectra within an elliptical cylinder phantom containing H, C, N, and O. (CH)

6250 (BARC-773) MECHANISMS OF RADIORESISTANCE AND ITS MODIFICATION BY CHEMICALS. Singh, B. B.; Shenoy, M. A.; George, K. C.; Joshi, D. S.; Bhatt, B. Y. (Bhabha Atomic Research Centre, Bombay (India). Biology and Agriculture Div.). 1974. 42p. Dep. NTIS (US Sales Only) $5.25.

Progress is reported on the testing of chemical radiosensitizers of hypoxic cells for possible use in cancer radiotherapy. Results are reported for organic and inorganic iodine compounds, sulfhydryl compounds, sodium nitrate, nitrous oxide, and a number of drugs used as anesthetics, analgesics, hypnotics, and tranquilizers. The compounds were tested for radiosensitizing ability and toxicity in γ-irradiated cultured mammalian cells and bacteria. (CH)

6251 (COO-3243-3, pp 11-23) SPECIALIZED DOSIMETRY AT RARAF. Marino, S. A.; Mills, R. E.; Goodman, L. J. 1 Jul 1974.

In annual report on research project.

Neutron dosimetry for various studies of biological radiation effects are described. (MCG)

6252 (COO-3243-3, pp 199-221) SPLIT DOSE EXPERIMENTS WITH HYPOXIC CELLS. Hall, E. J.; Lehnert, S.; Roizin-Towle, L. A. 1 Jul 1974.

In annual report on research project.

Experiments are reported that elucidate the effect on repair of hypoxia induced by crowding mammalian cells at high cell concentration. Cultures of aerated and hypoxic hamster cells were exposed to single and fractionated doses of gamma radiation. Survival curves are shown and demonstrate that the dose required under hypoxic conditions is about three times greater than under aerated conditions. The significance of the results for radiotherapy is discussed. (HLW)

6253 (COO-3243-3, pp 222-232) RBE DETERMINATIONS ON RARAF USING HAMSTER CELLS CULTURED IN VITRO. Hall, E. J.; Novak, J.; Marino, S.; Goodman, L. 1 Jul 1974.

In annual report on research project.

RBE determinations were made that cover a much wider range of neutron energies than was previously possible. Using the Radiological Research Accelerator Facility, nine neutron energies ranging from 110 keV to 15 MeV were studied. A table is presented to show characteristics of the beams used. Cultures of hamster cells were exposed to various doses of neutrons, and a parallel series of cultures was exposed to graded doses of x rays. Graphs are presented to show survival curves and RBE values. (HLW)

6254 (COO-3243-3, pp 258-265) NEOPLASTIC TRANSFORMATION OF CELLS IN VITRO FOLLOWING SPLIT DOSES OF X RAYS. Borek, C.; Hall, E. J. 1 Jul 1974.

In annual report on research project.

Dose response relationships were calculated for transformation of cultured hamster embryo cells by x rays for single acute doses between 1 and 600 rads. Results indicated that potentially transformable cells were more sensitive to the lethal effects of the accumulated damage at higher doses. For split-dose experiments cultures were given a single dose of 50 rads or 2 doses of 25 rads separated by a time interval of 5 hrs. Results showed a clear increase in the proportion of transformed clones when the doses were delivered in 2 fractions as compared with the same total dose given at a single exposure. The significance of the results for radiation protection is discussed. (HLW)

6255 (COO-3243-3, pp 275-282) EFFECT OF CYCLIC AMP ON THE RADIATION RESPONSE OF SYNCHRONOUSLY DIVIDING CELLS. Lehnert, S. 1 Jul 1974.

In annual report on research project.

Experiments were conducted to test the hypothesis that changes in radiosensitivity and intracellular cyclic AMP concentration during the division cycle occur in a parallel manner and are interdependent. To do this cyclic AMP concentration and post-irradiation survival were determined simultaneously at various times after synchronization of hamster cells. Results indicated that changes in cyclic AMP level and radiosensitivity occurred in a parallel manner and suggested that one of the factors governing post-irradiation survival of a cell at any point in the division cycle is the cyclic AMP concentration in the cell at the time of irradiation. (HLW)

6256 (ORNL-4979) HEALTH PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1974. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 298p. Dep. NTIS $7.60.

Separate abstracts were prepared for each of 45 sections of the report. Lists of theses, papers, publications, and lectures are included. (MCG)

For abstracts of individual sections see: 5850, 5983, 5994, 6095–6097, 6169, 6257–6259, 6293–6296, 6344–6348, 6366, 6373, 7110, 7123, 7136–7140, 7423–7433, 7451, 7666, 7725, 7944, 7960, and 7979.

6257 (ORNL-4979, pp 173-174) THEORETICAL RADIATION PHYSICS: TWO-COMPONENT MODELS OF CELLULAR SURVIVAL. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The models approximate survival in terms of two mechanisms: an irreversible mechanism in which a single event produces a fatal lesion and a reversible mechanism in which sublethal damage results from a single event but the cumulative effect of more than one such event can produce cell death. (MCG)

6258 (ORNL-4979, pp 233-235) ATOMIC PHYSICS: MICRODOSIMETRY. Hurst, G. S.; Garrett, W. R.; Judish, J. P.; Klots, C. E.; McNeely, J. R.; Payne, M. G.; Wagner, E. B. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The probability of radiation damage in relation to the amount of energy deposited in a sensitive volume having dimensions of the order of magnitude of a cell nucleus is discussed. Microdosimetry was applied to several models of cell survival. (MCG)

6259 (ORNL-4979, pp 235-240) ATOMIC PHYSICS: THEORETICAL MODELS FOR LOW-SET CELL-SURVIVAL STUDIES. Hurst, G. S.; Garrett, W. R.; Judish, J. P.; Klots, C. E.; McNeely, J. R.; Payne, M. G.; Wagner, E. B. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

It is shown that any model that hopes to explain most of the experimental facts must include as a minimum the following features: statistical fluctuations associated with direct and indirect effects; the phenomenon of repair and the action of radiation on the repair mechanism; the possibility of both reparable and irreparable damage; the action of chemicals believed to stop repair; and the idea of a "fixation time" and other cell-cycle effects. (MCG)

6260 CELL CYCLE DISTURBANCES IN SLOWLY GROWING SUBLINES ISOLATED FROM X-IRRADIATED L5178Y-S CELL POPULATIONS. Beer, J. Z.; Bocian, E.; Budzicka, E.; Szumiel, I.; Ziemba-Zak, B.; Kopec, M. (Inst. of Nuclear Research, Warsaw). Nukleonika; 19: No. 9, 835-843(1974).

The cell cycle was analyzed autoradiographically in a control line of murine leukemic lymphoblasts L5178Y-S and in two slowly growing sublines isolated from cell cultures irradiated with 300 rads of x rays. Prolongation of the cell cycle in the slowly growing sublines is connected primarily with delayed progression through G2 phase. This conclusion was further supported by results of determination of DNA content per cell in 13 slowly growing cell sublines and karyotype analysis of 18 sublines. No correlation was found between a sublines' mean doubling time and its chromosome number whereas DNA content per cell was clearly dependent on the growth rate. (auth)

6261 RADIOSENSITIZATION OF ANOXIC MAMMALIAN CELLS. Agnew, D. A. Hamilton, Ont.; McMaster Univ. (1972). 160p. National Library of Ottawa.

Thesis.

Research was performed to (a) better understand the mechanisms of chemical radiosensitization of mammalian cells so that the most effective compounds may be selected for radiotherapeutic use, and (b) to possibly explain the failure of early attempts to sensitize mammalian cells in vivo using chemical radiosensitizers. The effect of triacetoneamine N-oxyl (TAN) and several electron-affinic compounds on the colony forming ability of mammalian cells irradiated at both high and low cell concentrations was studied. A possible mechanism of sensitization for TAN was proposed. (auth)

6262 FORMATION AND RECOMBINATION OF SINGLE BREAKS IN DNA OF HeLa ^{63}Zh CELLS AFTER γ IRRADIATION. Pinto, R. I.; Vikhanskaya, F. L.; Fal'kovskaya, L. P.; Semenova, L. G. (Inst. of Cytology, Leningrad). Dokl. Biol. Sci.; 214: No. 1-6, 39-41(1974).

Translated from Dokl. Akad. Nauk SSSR; 214: No. 3, 691-693 (Jan 1974).

Quantitative data were obtained on single-strand breaks in DNA, induced by irradiation of cells at doses close to the biological, and on their recombination under various conditions of incubation. Irradiation at doses of 1000 to 4000 rads gave pronounced shifts in the direction of light fractions. Incubation of cells irradiated at a dose of 1000 rads at 37°C for 15 min displaces the distribution of DNA in the direction of heavy fractions. The introduction of caffeine to the incubation medium decreases the effect of rejoining by threefold and changes the shape of the distribution peak. (ERB)

Radiation Effects on Microorganisms

Refer also to abstracts 6247, 6250, and 6276.

6263 (BARC-742) METHOD FOR THE PREPARATION OF INDICATIVE LABELS FOR IDENTIFICATION OF GAMMA STERILISED MEDICAL PRODUCTS. Krishnamurthy, K.; Navada, S. V. (Bhabha Atomic Research Centre, Bombay (India). Isotope Div.). 1974. 9p. Dep. NTIS (US Sales Only) $4.00.

A method for the preparation of indicative labels for the identification of medical products sterilised by γ radiation is presented. A number of dye-polymer systems have been examined and the most promising ones have been selected for large scale preparation. The stability of the dye systems in various environmental conditions such as humidity, heat, ultraviolet, infrared, sunlight, oxygen, etc., has been studied. The specificity of response of the dye system to γ radiation has been established. (auth)

6264 (COO-3243-3, pp 193-198) RADIOSENSITIZATION OF HYPOXIC CELLS WITH METRONIDAZOLE. Hall, E. J. 1 Jul 1974.

In annual report on research project.

Difficulties in finding an agent that selectively potentiates radiation effects on tumor cells without affecting normal tissues are pointed out. The recent development of compounds that selectively sensitize hypoxic cells is a promising field of research. Previously reported studies show that metronidazole sensitizes Serratia marcescens and Vicia fabia seedlings to the lethal effects of gamma radiation under hypoxic conditions. Metronidazole reduced the OER of neutrons and of x rays. (HLW)

6265 (SAND-74-0269) KINETIC MODEL FOR THE BIOLOGICAL EFFECTS OF IONIZING RADIATION. Brannen, J. P. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1974. Contract AT(29-1)-789. 36p. Dep. NTIS $5.00.

A kinetic derivation of sensitive target volumes for biological materials is presented which includes both temperature and dose rate as environmental parameters. (CH)

6266 SOIL MICROFUNGI OF A CHRONICALLY IRRADIATED OAK–PINE FOREST. Gochenaur, S. E.; Woodwell, G. M. (Adelphi Univ., Garden City, NY). Ecology; 55: No. 5, 1004-1016 (Sum 1974).

The effects of chronic ionizing radiation on the soil microfungal community of an oak-pine forest was investigated by the dilution plate method and the contact slide technique. Twenty samples were collected and 10 slides inserted in the soil at each of 10 points along a radiation gradient varying from less than 1 to over 1800 R/day 2 cm below ground. A minimum of 55 fungi were selected at random off the isolation plates prepared from each of the 200 soil samples, and 5 slides per dose were examined. The 15,770 isolates obtained were distributed among 267 taxa. Subsurface radiation levels in the vegetated area ranged from less than 1 R/day in the undisturbed forest to 20 R/day under an almost pure stand of Carex pensylvanica. These exposures only indirectly affected the microfungi, producing minor distributional changes. Species diversity remained virtually constant throughout the area. The mean propagule level was approximately 100,000/g dry soil. Moniliaceous and mucoraceous fungi producing upright, morphologically complex reproductive structures characterized the population. The eight most abundant fungi, typically isolated throughout the world from podzolic soils supporting coniferhardwood forests,

were Penicillium terlikowskii, Mortierella isabellina, Aspergillus parvulus, Oidiodendron tenuissimum, P. nigricans, P. spinulosum, Monocillium humicola v. brunneum, and Mortierella nana. These eight taxa represented 71% of the isolates but only 5% of the species. A transitional zone devoid of higher plants except for a few scattered clumps of carex had a subsurface radiation level of 70 R/day. Species diversity was greatest in this region, where mesic and pioneer populations overlapped. The mean number of fungi was approximately 16,000/g dry soil. Only a few dominant forms of low density occurred in this area, notably, P. funiculosum, P. purpurogenum, Trichoderma viride, P. terlikowskii and Monocillium humicola v. brunneum. Distributional patterns of the microfungi correlated with the radiation gradient in the Devastated Zone, a region with no living higher plants. At subsurface radiation exposures of 175-1,250 R/day, no species was abundant and the mean number of propagules was reduced to approximately 3,000/g dry soil. Coefficient of community (CC) values and morphological complexity decreased as exposures to radiation increased. CC_{50} occurred at 1,600 R/day. Species diversity was reduced but remained constant along the gradient as shifting groups of more and more resistant forms occurred, culminating in a population dominated by the morphologically simple yeasts. A subsurface radiation level of 1,830 R/day, the maximum dose in this study, reduced the fungi to a mean level of only 500 propagules/g dry soil. The population contained yeasts but was characterized by intensely melanized, extremely slowgrowing, sterile isolates capable of producing only a rudimentary pseudomycelium. It is postulated that these are the most radioresistant of the fungi isolated and that resistance is related to their pigmentation. The contact slide results were comparable to those obtained by the dilution plate method except that basidiomycetes, not isolated by the latter, were the most radiosensitive fungi. Their dicaryotic hyphae were not observed on any slides receiving over 500 R/day. (auth)

6267 STUDIES ON THE RADIATION TREATMENT OF ANIMAL FEED. Muenzner, R. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe (F. R. Germany). Inst. fuer Strahlentechnologie). Zentralbl. Bakteriol., Parasitenk., Infektionsk. Hyg.; 158: 588-592(1974). (In German).

1 tab.; 7 refs.

Total microbial counts and viable fungi were determined in 106 different samples of commerical feeds for small animals. Viable fungi were found in 70 samples, and these were irradiated with electrons, applying a dose of 500, 750 or 1,000 krad. After irradiation, viable fungi were observed in 10 of the samples irradiated with 750 krad and in none of the samples irradiated with 1,000 krad. (auth)

6268 HYDROCARBON UTILIZING MUTANTS OF SACCHAROMYCES YEAST. II. Marking and Hybridization of Original Strains. Inge-Vechtomov, S. G.; Simarov, B. V.; Rabinovich, E. G. (Leningrad State Univ.). Genetika; 10: No. 9, 106-115 (Sep 1974). (In Russian).

Auxotrophic mutants were isolated from two homothallic strains of Saccharomyces cerevisiae (41 and 768) which were able to produce mutants capable for hydrocarbon utilization. The hybrids of auxotrophic mutants and mutants of heterothallic Peterhoff genetic strains of S. cerevisiae were obtained and studied. The monogenic difference in homo-heterothallism between Peterhoff genetic strains of yeast and the strains 41 and 768 were observed. It was shown that aberrant tetrade segregation in several hybrids resulted from aneuploidy. (auth)

6269 SELECTION AND CHARACTERIZATION OF UV-RESISTANT REVERTANTS OF recA STRAINS OF ESCHERICHIA COLI K-12. Torosyan, M. V.; Shishkova, O. V.; Rabinkova, E. V. Genetika; 10: No. 9, 123-132(Sep 1974). (In Russian).

The results are presented of a study of uv-resistant revertants of some recA strains induced by different mutagens. It is shown that some of produced revertants differ from original recA strains in some properties. It is established that all uv-resistant revertant fall into three phenotypic groups on their recombination proficiency in crosses with different donor strains (Hfr C, Hfr 3.0SO, F' W1655) and in their sensitivity to uv and gamma rays. It is concluded that all UV^r revertants are rec A^+ and carried mutations either in the same recA gene (true reversion or intragenic suppression) or in genes closely linked with recA. (auth)

6270 RADIATION STERILIZATION OF ABSORBENT COTTON AND DRESSINGS. Ramkova, N. V.; Bazhbeuk-Melikova, T. V. Gig. Sanit.; No. 8, 64-66(Aug 1974). (In Russian).

Dressing materials in standard packaging were sterilized with 2.5 Mrads of gamma radiation (^{60}Co). The physico-mechanical, and physico-chemical properties of the irradiated products were satisfactory. (MC)

6271 EFFECT OF X-RAY MUTANTS AND OTHER STIMULANTS ON ENZYME PROCESSES IN MILK PRODUCT FORMATION. Dilanyan, Z. Kh.; Saakyan, R. V.; Sarkisyan, R. A.; Sagoyan, A. S.; Chuprina, D. F.; Amirkhanyan, R. A. (Erevan Veterinary Inst.). Biol. Zh. Arm.; 27: No. 6, 70-74(Jun 1974). (In Russian).

The use of x-ray mutant strains of milk-oxidizing bacteria, microelements, and yeasts in the production of milk products stimulated microbiological processes. The time for ripening of the products was shortened and the quality was improved. (tr-auth)

6272 EFFECT OF GAMMAPHOS AND CYSTEINE ON SURVIVAL OF ESCHERICHIA COLI EXPOSED TO X RAYS AND HIGH-ENERGY ELECTRONS. Simonyan, N. V.; Dzhanpoladyan, N. L.; Adzhyan, S. A.; Avakyan, Ts. M.; Adzhyan, N. S. (Erevan Physics Inst.). Biol. Zh. Arm.; 27: No. 2, 91-94(Feb 1974). (In Russian).

Gammaphos and cysteine did not protect E. coli against 6.5 or 19.5 krad of 50-MeV electrons, but cysteine had some effect against x rays, the maximum effect being for an absorbed dose of 6180 rads. The biological effectiveness of the electron irradiation was lower than that of the x rays. (MG)

6273 MICROBIOLOGICAL ASPECTS OF RADIATION STERILIZATION. Kumta, U. S.; Lewis, N. F. (Bhabha Atomic Research Centre, Bombay (India). Biochemistry and Food Technology Div.). pp 37-57 of Radiation Sterilization of Medical Products. Report on the Colloquium Held at Bhabha Atomic Research Centre on August 17-18, 1973. Bombay; Bhabha Atomic Research Centre (1973).

From colloquium on radiation sterilization of medical products; Bombay, India (17 Aug 1973). 14 figs.; 9 refs.

Problems associated with gamma sterilization of medical products are discussed. The advantages and limitations of radiation sterilization by heat and chemicals are summarized. Since microorganisms vary greatly in their radiation sensitivities, the different phases in growth cycles of spore bearing organisms have to be considered, prior to assessment of the dose required for a particular treatment. (INIS)

6274 FUNDAMENTALS OF NUCLEAR SCIENCE: WITH APPLICATIONS IN AGRICULTURE AND BIOLOGY. Tiwari, P. N. Halsted Press Book. New York; John Wiley and Sons, Inc. (1974). 176p. $7.95.

The book is divided into two parts. In Part I, the basic concepts of nuclear science are discussed including: the atom; the nucleus; radioactivity; interaction of nuclear radiation with matter; nuclear radiation detection and measurement; and radiation protection. In Part II, the applications of nuclear science in agriculture and biology are discussed including: tracer studies; nuclear analytical techniques; and nuclear irradiation applications (mutations, food preservation, and pest control). (ERB)

6275 ENERGY TRANSFER BETWEEN PROTEIN AND DNA IN BACTERIOPHAGE. Lillicrap, S. C.; Fielden, E. M.; Dewey, D. L. (Inst. of Cancer Research, Sutton, Eng.). Int. J. Radiat. Biol.; 26: No. 1, 76-71(Jul 1974).

After pulsed irradiation, the luminescence of compacted samples of Bacteriophage T7, heat-inactivated T7, and the separate DNA and protein components was observed. Irradiation was carried out at 93°K, and both the emission spectra and decay characteristics were recorded. The results were interpreted as showing that some energy transfer from the protein to the DNA occurred. Heat-inactivated phage, which has the DNA outside the protein coat, did not display such energy transfer. It is proposed that there are sufficient points of close contact between the DNA and protein in the intact phage to account for the observed transfer. (auth)

Radiation Effects on Plants

Refer also to abstracts 6251, 6264, 6265, 6274, 8041, 8045, and 8047.

6276 (COO-3243-3) ANNUAL REPORT ON RESEARCH PROJECT. Rossi, H. H. (Columbia Univ., New York (USA). Radiological Research Lab.). 1 Jul 1974. Contract AT(11-1)-3243. 291p. Dep. NTIS $7.60.

Separate abstracts were prepared for each of the 23 sections. (MCG)

For abstracts of individual sections see: 6087-6094, 6251-6255, 6264, 6277, 6278, 6858, 7109, 7419-7421, 8051, and 8052.

6277 (COO-3243-3, pp 167-191) RBE AND OER STUDIES WITH TRADESCANTIA. Underbrink, A. G. 1 Jul 1974.

In annual report on research project.

A literature review of studies on RBE includes: experimental end points such as types of somatic aberrations, mutations, or loss of reproductive integrity; dose; dose rate; neutron energy; nitrogen ions; hypoxia; ploidy level; and interphase chromosome volume. Studies indicated a dependence of OER on neutron energy when pink mutations in Tradescantia stamen hairs were scored after irradiation. A table is presented to show RBE and OER values for pink mutant events in Tradescantia stamen hairs following irradiation with neutrons of various energies and x rays under conditions of light and darkness. Results are reported for studies on OER values at x-ray doses below 5 rads and for studies on OER and RBE at high doses. Results are also reported for the following studies: the influence of light on RBE; pollen abortion studies; and RBE experiments with haploid fern gametophytes of two Osmunda species. (HLW)

6278 (COO-3243-3, pp 233-246) COMPARATIVE RADIOBIOLOGICAL MEASUREMENTS WITH HIGH ENERGY CYCLOTRON-PRODUCED NEUTRONS. Hall, E. J.; Novak, J. K.; Marino, S. A. 1 Jul 1974.

In annual report on research project.

The use of cyclotrons originally built for high energy physics research for radiotherapy is discussed. Experiments were conducted on Vicia seedlings under hypoxic conditions. OER and RBE values were determined for neutrons from the 50 MeV TAMVEC accelerator and the 35 MeV NRL cyclotron. Other experiments were conducted on cultured hamster cells under aerated conditions; survival curves are shown for high energy neutron beams and x rays. A discussion is given of variations of RBE with neutron dose. (HLW)

6279 EFFECT OF X RAYS ON VARIABILITY IN M_2 PEPPER PLANTS. Terzyan, R. T.; Saakyan, T. A. Biol. Zh. Arm.; 27: No. 5, 103-106(May 1974). (In Armenian).

Mutants were produced in Capsicum annum by 10,000- to 20,000-R doses of x rays. The frequency of mutants was higher with the higher doses. The frequency of mutant formation differed with the strain of pepper treated. (tr-auth)

6280 ACTION OF X RAYS ON MITOTIC ACTIVITY AND FREQUENCY OF CHROMOSOME ABERRATIONS IN CAPSICUM ANNUUM L. ROOT TIPS. Terzyan, R. T.; Batikyan, G. G.; Saakyan, T. A. Biol. Zh. Arm.; 27: No. 3, 35-39(Mar 1974). (In Armenian).

In pepper seeds irradiated with 500 to 30,000 R, mitotic activity was stimulated by the lower doses (up to 10,000 R, depending on the variety). The higher doses inhibited cell division, and at 20,000 R the frequency of chromosome rearrangement was maximum. At 30,000 R anomalous effects were observed. (MG)

6281 ANALYSIS OF POLLEN OF X-IRRADIATED WHEAT MUTANTS. Shakaryan, Zh. O.; Avakyan, V. A. Biol. Zh. Arm.; 27: No. 3, 97-99(Mar 1974). (In Armenian).

The properties of pollens from mutants and from the original soft wheats after x irradiation are reported. X irradiation increased the amount of pollen in the stamens of both the mutants and the initial strains except type Bezostaya-1. A 15-kR x-ray dose decreased the amount of pollen and the fertility of the original wheats, but only slightly decreased the fertility of the pollen of the mutants. The radiation sensitivity of the pollens from the mutants and from the original wheat is considered to be very similar. (tr-auth)

6282 DOSE RESPONSE OF THE FREQUENCY OF POTENTIAL CHROMOSOME LESIONS INDUCED BY GAMMA RAYS. Bagrova, A. M.; Protopopova, E. M.; Shapiro, N. I. (Moscow State Univ.). Genetika; 10: No. 9, 28-34(Sep 1974). (In Russian).

The character of the dose-response was studied for actual (not requiring exposure to oxygen) and for the potential (developed by oxygen treatment) chromosome lesions induced by gamma-irradiation of dry seeds. As it is shown by mathematical analysis, the experimentally obtained frequencies of chromosome aberrations for all the variants of the experiment, are adequately described by the regression equation of the type: $y = \alpha D + \beta D^2$. It is established that the ratio between the one-hit and the two-hit components depends on the presence or absence of oxygen during the post-irradiation soaking of seeds. The contribution of the linear component increases with the increase of the oxygen content. This suggests that it decisively depends on the oxygen-dependent potential lesions. Since the character of the dependence on the irradiation dose is considerably different for potential and actual chromosome lesions, it is justified to assume that the mechanisms of their initiation are also different. It is also shown that the relative proportion of oxygen-sensitive potential chromosome lesions decreases with the increase of the irradiation dose. (auth)

6283 RADIOBIOLOGY WITH THE NEUTRON BEAM AT THE NRL CYCLOTRON. Hall, E. J. (Columbia Univ., New York); Roizin-Towle, L.; Theus, R. B.; Attix, F. H. Trans. Amer. Nucl. Soc.; 19: 51(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6284 EFFECT OF CHEMICALS ON REPAIR OF PRIMARY RADIATION DAMAGE TO CREPIS CAPILLARIS CHROMOSOMES. Batikyan, G. G.; Martinrosyan, S. N.; Mikaelyan, S. G.; Ananova, Z. M. (Erevan State Univ.). Biol. Zh. Arm.; 27: No. 2, 41-45 (Feb 1974). (In Russian).

Alanine and arginine protected the C. capillaris seeds from damage by 4000 R of radiation. The time of application of the protective agent was important, between 3 and 12 hr after the irradiation being better than 1 hr after. (MG)

6285 INVESTIGATION OF POSSIBLE MUTAGENICITY OF EXTRACTS OBTAINED FROM IRRADIATED POTATO DEPENDING UPON ITS COOKING AND TIME OF STORAGE. Osipova, I. N. (Akademiya Meditsinskikh Nauk SSSR, Moscow. Inst. Pitaniya). Vop. Pitan.; No. 1, 78-81(Jan 1974). (In Russian).

Extracts from raw potatoes obtained immediately after irradiation of the product at a dose of 10 krad have mutagenic activity. After storage of the tubers for 40 or 90 days the extracts from the raw irradiated potatoes lose the mutagenic activity. As a result of boiling, the irradiated potatoes completely lose the mutagenic activity independent of the time passing after irradiation. (tr-auth)

6286 COMBINED AND SEPARATE EFFECT OF ETHYLENIMINE AND γ RAYS ON INHIBITION OF DNA SYNTHESIS. Sidorov, V. P.; Tarasov, V. A. (Inst. of General Genetics, Moscow). Genetika; 10: No. 10, 38-46(Oct 1974). (In Russian).

A combined and separate effect of ethylenimine and γ rays under depression of DNA synthesis was studied. The modifying effect of 5-aminouracil in irradiation of Crepis capillaris cells at the end of the G_1 stage was associated with the increased yield of aberrations of chromosome and chromatid types in diploid metaphases. In tetraploid cells the yield of chromatid aberrations was decreased as compared with the frequency of aberrations induced by γ rays. Modification of 5-aminouracil impairments induced by ethylenimine resulted in the decrease of yield of chromatid aberrations both in diploid and in tetraploid cells. In diploid cells the effect of combined treatment with ethylenimine and γ rays was significantly increased under modification by 5-aminouracil as compared with the combined treatment with mutagens but without any inhibitors of DNA synthesis. In tetraploid cells the ratio of chromatid aberrations did not exceed the additive level. (auth)

6287 MODIFICATION OF THE MUTAGENIC EFFECT OF GAMMA IRRADIATION FROM ^{137}Cs ON THE CELLS OF CREPIS CAPILLARIS SEEDS WHEN GERMINATED UNDER VARYING CONDITIONS OF SALINITY. Kiseleva, R. B.; Nemtseva, L. S. (Inst. of General Genetics, Moscow). Dokl. Biol. Sci.; 214: No. 1-6, 26-27(1974).

Translated from Dokl. Akad. Nauk SSSR; 214: No. 2, 442-444 (1974).

The results of the investigation show that the mutagenic effectiveness of ionizing radiations depends to a significant extent on the saline conditions in which the cell is present. Under these circumstances, saline conditions represent the conditions of nutrition for plant cells. The physiology of the cell, the functioning of the enzyme systems and, in consequence, the operation of the mutational process, are closely linked with the content of salts and with the conditions of nutrition. (auth)

Radiation Effects on Animals

Refer also to abstracts 5964, 6249, 6265, 7328, and 8048.

Man

Refer also to abstracts 5850, 5965, 5970, 5982, 6248, 6252, 6254, 6256, 6264, 6358, 6359, 6434, 7449, 7963, 8054, 8056, and 8061.

6288 (AD-781591) ANALOG DIGITAL COMPUTER FOR CALCULATING DOSE FIELDS. Balsevich, S. Ya.; Golovan, V. A.; Krangauz, A. N.; Apanasyuk, A. V.; Pavlova, T. G. Translated by V. Mesenzeff from Med. Radiol.; 17: No. 8, 38-46(1972). 19p. (FTD-HT-23-320-74). NTIS $3.00.

The authors developed a special-purpose analog-computer device for calculating dose fields and selecting an optimum plan of

irradiation. An arbitrary outline of a section is calculated with the consideration of the heterogeneous nature of the human body. One table and three illustrations are included. (GRA)

6289 (AECL-4960) METHOD OF MONITORING NATIONALLY FOR POSSIBLE DELAYED EFFECTS OF VARIOUS OCCUPATIONAL ENVIRONMENTS. Newcombe, H. B. (Atomic Energy of Canada Ltd., Chalk River, Ontario). Feb 1974. 45p. (NRCC-13686). Dep. NTIS (US Sales Only) $5.25.

A possible application of the methods of record linkage for following up large numbers of employed individuals over long periods to detect and measure the delayed consequences of exposures to carcinogenic, toxic and otherwise harmful agents and circumstances which may be inherent in industrial and other working environments is described. It is proposed that use could be made of existing centralized files of machine-readable records containing information about employment histories, and of the vital and health records systems, to monitor the whole of Canadian industry for possible delayed effects on health and well-being. Computer methods are discussed with a view to increasing the scale on which follow-up will be possible, while reducing the costs as compared with those of conventional approaches. (auth)

6290 (AED-CONF-74-140-001) CONSIDERATION OF BODY INHOMOGENITIES IN THE PLANNING OF DEEP ELECTRON IRRADIATION THERAPY. Fehrentz, D.; Schroeder-Babo, P. (Heidelberg Univ. (F. R. Germany). Strahlenklinik). 1974. 4p. (In German). INIS.

From German x-ray congress; Baden-Baden, F. R. Germany (25 Apr 1974).

To determine the effect of electron scattering on the dose distribution at the edges of the lung, depth dose distributions were measured in different distances from the border of a cork-water phantom. Independent of the depth, edge effects were found only within a distance of 3 cm from cork-water border area. (GE)

6291 (BNL-19213, pp 43-46) NANOMETER SCALE DOSIMETRY CALCULATIONS. Paretzke, H. G.; Kuehner, A. V. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

Detailed Monte Carlo type computer programs were employed to calculate dose as a function of radial distance from the path of heavy ions. These codes utilize double differential cross section data for secondary electron production by protons on nitrogen as input data. Semiempirical electron scattering and energy loss functions are incorporated to determine secondary electron trajectories and energy losses. Results for ions heavier than protons are calculated using an effective charge squared (Z^2) scaling function for secondary electron cross sections. Additional programs were developed to show plots of the secondary electron tracks and positions of all ionizations and all branches produced. When all electron tracks produced from a segment of heavy ion are followed, a clear picture of heavy ion's track structure is produced. The ions studied include ^{1}H, ^{4}He, ^{16}O and ^{127}I, all at specific energies of 1 MeV/amu. (CH)

6292 (BNWL-1858) DOSE-TO-THE-POPULATION ESTIMATES FOR USE OF RADIOISOTOPE POWERED CARDIAC PACEMAKERS. McKee, R. W.; Clark, L. L.; Cole, B. M.; Libby, R. A. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Sep 1974. Contract AT(45-1)-1830. 72p. Dep. NTIS $5.45.

Estimates were made of the radiation dose to the population that would result from wide use of cardiac pacemakers powered by small quantities of ^{238}Pu. A radioisotope powered cardiac pacemaker (RPCP) requires only a few tenths of a gram of ^{238}Pu for its power source and most of the radioactive decay energy is converted to heat. However, there is a small component of external γ and neutron radiation emitted from these devices. For example, the dose rate at a distance of three feet from an implanted RPCP is on the order of 0.001 mrem/hr. Since there may be several hundred thousands of these devices eventually in use, it is important to characterize the dose-to-the-population risk. Development of these estimates requires assumptions regarding who will use the device, how many will be in use, how long the users will live, and determination of how they will interact with the rest of the population. It was possible to adapt the results of a comprehensive analysis of a similar problem, the dose-to-the-population estimates for ^{238}Pu powered artificial hearts carried out under the AEC's artificial heart program, to this pacemaker analysis. The scope of this study included: projections of radioisotope powered pacemaker use as a function of time based on estimates of the rate of implantation and life expectancy of recipients; dosimetry calculations to estimate the external dose rates transmitted to others from an implanted radioisotope powered pacemaker; and dose-to-the-population calculations based on data developed and utilizing a computer program (REPRIEVE) and interpersonal time and distance data developed for dose-to-the-population studies carried out as a part of the AEC's artificial heart program. (CH)

6293 (ORNL-4979, pp 40-45) ABSORBED DOSE IN MALE HUMANOID PHANTOMS FROM EXTERNAL SOURCES OF PHOTONS AS A FUNCTION OF AGE. Warner, G. G.; Poston, J. W.; Snyder, W. S. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The effect of age on absorbed dose and on specific absorbed fraction when six phantoms of various ages were immersed in infinite external sources of photons was investigated. An IBM 360/91 computer was used for the studies. At each of 12 energies, 60,000 monoenergetic photons were initiated externally and allowed to impinge on the surface of each of the six male phantoms which represented a newborn, a 1-year-old, a 5-year-old, a 10-year-old, a 15-year-old, and an adult. The younger phantoms were created by reducing the adult in similitude; that is, a coordinate point in the adult was transformed to a coordinate point in a younger phantom by factors separate for each coordinate axis. Data are presented on the dose to the testes that show an increased dose of up to 31% for infants when compared with adults. (CH)

6294 (ORNL-4979, pp 47-59) MEDICAL X-RAY DOSE ESTIMATION PROGRAM. Poston, J. W.; Warner, G. G. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Data are presented from a study of absorbed doses to internal organs of the body due to external sources of x-ray beams in the energy range 20 to 150 keV. The primary objective of this research was the calculation of absorbed dose in several critical internal organs per unit surface radiation exposure for normally incident external x-ray beams. Organs of primary interest are the ovaries, testes, thyroid, lenses of the eyes, and the red bone marrow. Calculations for 4 × 4 cm beams incident on the front (anterior-posterior, AP) of a phantom were completed for monoenergetic photons of 30, 55, and 80 keV. Several modifications were made to the existing phantom geometry, and a duplicate set of calculations for beams incident on the rear (posterior-anterior, PA) of the phantom were completed. These data are presented in tabular form. (CH)

6295 (ORNL-4979, pp 60-67) ABSORBED DOSE TO SELECTED INTERNAL ORGANS FROM TYPICAL DIAGNOSTIC X-RAY EXPOSURES. Poston, J. W.; Warner, G. G. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Two diagnostic x-ray procedures were simulated on a computer, and the Monte Carlo technique and the phantom geometry were used in calculations of the radiation dose absorbed by selected internal organs. Eight computer runs consisted of a set of exposures which simulated a chest x ray, and eight runs consisted of a set of exposures each of which simulated a gastrointestinal tract x ray. Each of the 16 exposures consisted of a collimated 36 × 44 cm (14 × 17 in.) beam of 120,000 parallel photons incident on the rear of a phantom (posterior-anterior incidence, PA). In these calculations the source input was a set of eight measured x-ray energy spectra due to Epp and Weiss. The spectra range from 45 kVp, 1 mm aluminum filtration to 105 kVp, 2 mm aluminum filtration. The energy of each photon was determined from a normalized distribution of relative photon fluences per unit energy interval between 10 and 102 keV. Monte Carlo methods were used to follow the transport of each photon through the phantom, determining the scattering angles, absorption sites, etc., and permitting the estimates of absorbed dose in units of absorbed dose per unit incident exposure (rads/R). (CH)

6296 (ORNL-4979, pp 189-196) DOSIMETRY FOR HUMAN EXPOSURES AND RADIOLOGICAL IMPACT. Kerr, G. D.; Abdullah, S. A.; Auxier, J. A.; Cheka, J. S.; Dickson, H. W.; Fox, W. F.; Jones, T. D.; Lupica, S. B.; Shonka, J. J.; Wilhoit, D. G. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

A study was made of the radiation exposure to atomic bomb survivors of Hiroshima and Nagasaki, Japan, who are now residing in the United States. Recent survey information on 69 survivors was analyzed in cooperation with the Atomic Bomb Casualty Commission (ABCC) in Hiroshima and Nagasaki. In all but one of 22 cases where this information could be compared with information in the Master Files of the ABCC obtained at a much earlier date, the agreement on location and shielding was excellent. With additional information found in the files of the ABCC, it was possible to make tentative estimates of 44 individ-

uals' radiation exposure. Estimates of radiation exposure in the other 25 cases were not considered usable either because an exact identification of the individual could not be made or because sufficient data could not be obtained. Without an exact identity, such as a maiden name, it was not possible to search the files of the ABCC for additional information. The ABCC has radiation dose estimates for most of the 117,000 atomic bomb survivors in the Master Sample. However, these estimates, denoted T65D, actually predict dose or kerma to infinitesimal amounts of human tissue under exact analog exposure conditions, except for the absence of the specific survivor. Because attenuation and multiple scattering by the body are neglected in these estimates, they are inadequate to assess the dose to some internal organs of survivors and to survivors exposed in utero. A complete transport calculation of dose inside the body of each survivor is impractical due to the large amount of modeling necessary to describe the body and all the shielding in close proximity to the survivor. Hence the current objective is to establish generalized techniques that can be used easily to estimate in-vivo doses from the T65D estimates in specific cases of interest. (CH)

6297 (PB-231036) PLOWSHARE TECHNOLOGY ASSESSMENT. Biological and Ecological Considerations. Johnson, J. E. (Western Interstate Nuclear Board, Lakewood, Colo. (USA)). May 1973. Contract NSF-GT-21. 24p. (NSF/RA/G-73-018). NTIS $4.25.

The report summarizes pertinent information on somatic and genetic effects on humans, animals and plants from low-level radioactivity such as might be present in the environment from nuclear stimulation of natural gas formations. It is concluded that no measurable acute or long term effects will be expected from the radioactivity released under normal execution of any single event. (GRA)

6298 TREATMENTS OF RADIOCOMPLICATIONS CAUSED BY RADIOTHERAPY. Radiation Syndrome Caused by Radiotherapy, Especially Bladder Injuries and Its Treatments. Sato, S. (Niigata Univ., Japan). Nippon Geka Gakkai Zasshi; 74: No. 11, 1345-1348(Nov 1973). (In Japanese).

Described were radiotherapy of vesical tumor and gynecology and complications in the School of Medicine of Niigata University. From 1963 to 1972, 134 patients with vesical tumor (101 males and 33 females) were treated at the Department of Urology. The degree of progress of tumor and therapies (extirpation, single changing of direction of urinary tract, irradiation, and chemotherapy) were tabulated. Of the 45 cases exposed to radiation, extirpation was combined in 25 cases. Side effects of radiotherapy and various symptoms manifesting themselves during and after irradiation were observed in 42 cases. They are classified into 14 cases of leukocytopenia, 19 cases developing fever, 3 cases of general malaise, 6 cases of headache, 2 cases of vertigo, 19 cases of digestive symptoms such as poor appetite, 12 cases of rectal symptoms such as bloody discharge, and 12 cases of vesical symptoms such as polyuria. Complications in the lower urinary passages to which importance should be attached to radiotherapy are radiation cystitis, hemorrhagic cystitis, vesical atrophy, urethral structure, vesicovaginal fistula, and vesicovaginorectal fistula, and therapies for them such as chemotherapy and changing of direction of urinary tract were examined. (JA)

6299 OXYGEN SUPPLY OF UTERINE CERVIX CANCER AND RADIATION RESPONSE WITH SPECIAL REFERENCE TO MENSTRUAL HISTORY. Siracka, E.; Schreiner, P.; Siracky, J.; Manka, I. (Cancer Research Inst., Bratislava). Neoplasma; 21: No. 4, 433-439(1974).

In a series of 230 uterine cervix cancer patients treated by radiation analysis of treatment results were made with special reference to the menstrual history. In a group of climacteric patients significantly worse results were obtained as compared to patients in fertile age with regular menstrual history or postmenopausal patients. Our data suggest that reduced oxygen tension in cervical capillary blood due to vasomotoric disturbance in climacteric patients, as proved by other authors, is responsible for the unfavorable effect of radiation treatment. In considering the known facts regarding the oxygenation and reoxygenation of the tumor tissue, treatment modifications in the conventional treatment routine are suggested to improve the cure rate. (auth)

6300 METHOTREXATE IN COMBINATION WITH RADIOTHERAPY IN THE TREATMENT OF SQUAMOUS CARCINOMAS OF THE HEAD AND NECK. Klimo, J.; Danko, T. (Univ. Teaching Hospital, Kosice, Czech.). Neoplasma; 21: No. 4, 451-454 (1974).

Over the period 1969 to 1973 a total of 48 patients with squamous carcinomas of the head and neck were treated with Methotrexate and irradiation, ten of them receiving the drug intravenously and 38 perorally, always before application of radiotherapy. In the majority of the patients, this combination resulted in an immediate short-term regression of the carcinomas in Stage II and III. A better therapeutic effect with lesser adverse effects was observed with the intravenous mode of Methotrexate administration. The analysis of the data does not permit any reliable statement to be made as yet concerning the long-term survival of the patients. (auth)

6301 THYROID CARCINOMA AFTER EXPOSURE TO ATOMIC RADIATION. A Continuing Survey of a Fixed Population, Hiroshima and Nagasaki, 1958–1971. Parker, L. N.; Belsky, J. L.; Yamamoto, T.; Kawamoto, S.; Keehn, R. J. (Atomic Casualty Commission, Washington, DC). Ann. Intern. Med.; 80: 600-604(May 1974).

A survey of histologically verified thyroid carcinoma in the Atomic Bomb Casualty Commission–Japanese National Institute of Health (ABCC-JNIH) Adult Health Study, from July 1958 through October 1971 was made, using as sources of tumor information results of periodic clinical examinations, autopsy diagnoses, surgical pathology reports, tumor registry listings, and death certificate diagnoses. Thyroid carcinoma was commoner in women and significantly more prevalent in persons exposed to 50 or more rads of atomic radiation 13 to 26 years previously. Carcinoma of the thyroid diagnosed during life was commoner in persons who were less than 20 years old when exposed in 1945; however, a radiosensitive period only in childhood, found in previous studies, was not shown in this study, since an increased risk was found even among persons who were 50 years old at the time of radiation exposure. (auth)

6302 EVALUATION PROCEDURE FOR A NUCLEAR MEDICAL DEPARTMENT. Metz, D. (Univ. of North Carolina, Chapel Hill); Malsky, S. J.; Blatt, C. J.; Hayt, D. B.; Frie, A.; Betar, P. A.; Macca, J.; Simon, D. Radiat. Data Rep.; 15: No. 9, 559-566 (Sep 1974).

Administrative, health physics, educational, instrumentation and space requirements for departments of nuclear medicine are discussed. The data were recorded from answers to a questionnaire and personal interviews with personnel in hospitals with varying bed capacities. Finally, a visual inspection was made of each department by personnel conducting the interview. (auth)

6303 ATTENTION: RADIOACTIVE MATERIAL-DANGER GROUP III-CONTAMINATED PERSON. Professional Firemen of Munich in Action. Bauer, H. (Berufsfeuerwehr Muenchen (F. R. Germany). Feuerwehrschule); Hildebrand, B. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). Brandschutz; 28: No. 2, 43-46(1974). (In German).

6 figs.

An activity of the Munich professional fire-brigade is described. In a research laboratory, a considerable personnel contamination occurred. A scientist worked with an R–Be neutron source, the Al-cladding of which leaked probably by corrosion, which led to a contamination of the left hand and arms. A complete decontamination was achieved and a follow-on measurement with the whole-body counter showed that only a very small amount of Ra–C (about 12 nCi) was incorporated. So further therapy was not necessary. (GE)

6304 A COMPARISON BETWEEN NEUTRON AND TELECOBALT THERAPY IN BRONCHIAL, STOMACH AND ESOPHAGEAL CARCINOMA. Eichhorn, H. J.; Lessel, A.; Matschke, S. (Deutsche Akademie der Wissenschaften zu Berlin (German Democratic Republic). Inst. fuer Krebsforschung). Strahlentherapie; 147: No. 6, 559-563(Jun 1974). (In German).

3 tabs.; 4 refs.

To examine the qualitative difference in efficacy between radiation of low and high LET on human tumours in vivo, 149 cases of bronchial carcinoma were irradiated with telecobalt only (control groups) and compared with 2 series of 25 and 15 cases, respectively, which had a cyclotron-neutron source for 20 and 35% of the total dose. The measure of the judgement of efficacy was the histological examination of all cases (in autopsy or surgical specimen) on vital tumour cells. Smaller comparative series of esophageal and stomach carcinomas were tested in the same manner. In all the series a significantly stronger effect was seen, if combined irradiation with neutron and gamma radiation was applied. The statistical examination of the comparability of the series (tumour volume, total dose, total exposure time, histological tumour types) confirmed the result of the qualitatively stronger neutron effect in every respect. The sequence of irradiations (neutron gamma or gamma-neutron) and the duration of the intervals between the irradiations had no influence. (auth)

6305 EVALUATION OF ABSORBED DOSE OF GAMMA AND X RADIATION USING BONE TISSUE AS A DOSIMETER. Stacho-

wicz, W. (Inst. of Nuclear Research, Warsaw); Michalik, J.; Dziedzic-Goclawska, A.; Ostrowski, K. Nukleonika; 19: No. 9, 845-850(1974).

The dose dependence curves were obtained showing the relation between the number of stable radiationinduced paramagnetic centers and radiation dose in the range of 100 to 20,000 rads. ^{60}Co source and 250 kV rtg apparatus were used. Differences in slopes of both curves are interpreted in terms of differences in the values of stopping power. The possibility to use skeletal tissues as dosimeter for absorbed doses in the range beginning at 10 rads is discussed. (auth)

6306 PHYSICAL CHARACTERISTICS OF THE NRL NEUTRON BEAM FOR RADIATION THERAPY. Theus, R. B. (Naval Research Lab., Washington, DC); Bondelid, R. O.; Attix, F. H.; August, L. S.; Shapiro, P.; Surratt, R. E.; Rogers, C. C. Trans. Amer. Nucl. Soc.; 19: 50(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6307 PRELIMINARY STUDIES FOR NEUTRON CANCER THERAPY TRIAL. Rogers, C. C. (Virginia Commonwealth Univ., Richmond). Trans. Amer. Nucl. Soc.; 19: 53-54(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6308 ABSORBED DOSE RATES IN HUMANS FROM EXPOSURE TO ENVIRONMENTAL GAMMA RAYS. O'Brien, K.; Sanna, R. S. (Atomic Energy Commission, New York). Trans. Amer. Nucl. Soc.; 19: 479-480(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6309 TWO SEVERE CASES OF ACUTE RADIATION DISEASE. Vorob'ev, A. U.; Brilliant, M. D.; Baranov, A. E.; Vyalova, N. A.; Gruzdeva, N. M.; Domracheva, E. V.; Pyatkin, E. K.; Selidovkin, G. D.; Tyurina, I. P.; Shorokhov, A. I. Ter. Arkh.; 45: No. 9, 85-93(1973). (In Russian).

These two cases of severe radiation illness in persons involved in a single accident show that the whole-body irradiation and its accidental character gave a similar damage picture. The irradiation dose was high: on the average 600 rad in the first case and 400 to 500 rad in the second patient. This dose led to a severe form of radiation sickness in both victims. However the degree of damage to separate tissues was not the same. Hence the clinical picture of the illness was also not at all the same. From the clinical symptoms and syndromes it was possible in each of the cases to determine the position of the victims at the time of the accident and the dose to individual tissues. From the therapeutic measures partly planned on admission of the patients (confinement under aseptic conditions, antibiotic therapy, refusal of hemotransfusions) but in great measure dictated by the onset of the sickness (transplantation of bone marrow, parenteral feeding), it was possible to manage the severe form of radiation sickness without substantial secondary complications. Basically all manifestations of the sickness and its duration were caused by the severity of the damage. Laboratory diagnostics made it possible to discern clearly the sickness as it developed. (tr-INIS)

6310 MEAN INTEGRAL ABSORBED DOSES IN THE ORGANISM OF PATIENTS SUBJECTED TO ROENTGENOLOGICAL PROCEDURES. Telichko, F. F.; Zimomrya, Yu. I.; Samodai, A. F.; Yazykov, A. S. (Uzhgorod State Univ., USSR). Vestn. Rentgenol. Radiol.; No. 5, 75-78(1974). (In Russian).

The mean values of exposure doses and of integral absorbed doses in the patients' organism during the roentgenological procedures were determined. The mean values of irradiation procedures were obtained by summing up the results of personal measurement of exposure doses of literature data. The values of the absorbed doses obtained in this way reflect the variety of technical, methodical, and other conditions of roentgenological studies conducted in different roentgenological rooms. Results of these studies can be used in assessing the extent of the radiation action from roentgenological procedures on the population and the patients under study. (auth)

6311 PERIPHERAL BLOOD IN CERVICAL CANCER PATIENTS AFTER RADIATION THERAPY. Solodkaya, V. V. (Vitebsk Medical Inst., USSR). Vop. Onkol.; 20: No. 7, 98-99 (1974). (In Russian).

The blood picture for 108 patients before and after radiation therapy is reported. Comparison of the data indicates that the blood-producing system is damaged by the radiation. (MG)

6312 BLOOD COAGULATION IN CERVICAL CANCER PATIENTS AFTER RADIATION THERAPY. Davydova, V. M. (Leningrad Inst. for Advanced Training of Doctors). Vop. Onkol.; 20: No. 7, 97-98(1974). (In Russian).

The blood of the subject patients examined 1 to 2 years after treatment showed a somewhat decreased blood coagulation time and heparin tolerance and a higher fibrinogen level and fibrin-stabilizing activity factor. After 2.5 to >5 years, all coagulation indexes were low except the fibrinogen level and fibrin stabilizing activity factor. Patients treated more than once showed a similar picture to these latter. (MG)

6313 CONTRIBUTION OF ISO-RET PLANS TO THE OPTIMIZATION OF DOSE DISTRIBUTION IN TELECURIETHERAPY. Matula, P.; Klavana, M.; Kunstadt, E.; Futas, E. (Safarik Univ. School of Medicine, Kosice, Czech.). Radiobiol.-Radiother.; 15: No. 3, 369-375(1974).

Using the Ellis' concept of NSD, the authors have summarized a general formula and using a computer, obtained a "ret-distribution" in a given cross section of the patient's body. These "iso-ret plans" give a quantitative and synoptical representation of the actual radiobiological dosage load on various tissues surrounding the tumor, just as the isodose plans give a graphical representation of physical dose distribution. It was found that the discrepancy between the ret-dosage and physical rad-dose distribution may exceed 20%, if inappropriate fractionation schemes are used. The computer program makes it possible to evaluate any fractionation scheme, taking into account possible gaps between irradiation series. Iso-ret plans may be useful for retrospective as well as prospective evaluation of irradiation and fractionation schemes, with the aim of their optimization. (auth)

6314 STABILITY OF AUSTRALIA (SH) ANTIGEN DURING IRRADIATIONS WITH A ^{60}Co THERAPY UNIT. Hollenbach, K.; Geserick, G.; Mueller, G. M.; Vogler, H. (Ernst-Moritz-Arndt-Univ., Greifswald, Ger.). Radiobiol.-Radiother.; 15: No. 3, 419-424(1974). (In German).

Full serum of 9 Au(SH)-carriers, 10 healthy Au(SH)-negative control persons, and immunologically pure antigen were irradiated with absorbed doses of 1.5, 1.25, and 1.75 Mrad in vitro by means of the gamma therapy unit "Rokus". Before and after irradiation, qualitative and quantitative examinations were made in immune diffusion, immune elektrophoresis, transmigration electrophoresis (immune precipitation electrophoresis), electrophoresis in antibody-containing agarosegel, and by means of paper electrophoresis. With rising absorbed dose β-globulins increased, whereas γ-globulins decreased (paper electrophoresis). In transmigration electrophoresis and semiquantitative electrophoresis in antibody-containing agarosegel an unequivocal concentration decrease of the Australia antigen was not found. An impairment worth mentioning of the immunological responsiveness of the Australia antigen could not be achieved by the absorbed doses used. How far infectivity of Au(SH)-antigen containing sera was influenced by the applied irradiations was not easily investigated with the practical model. (auth

6315 TRANSFORMATION OF AN X-RAY ULCER OF THE SCALP INTO CANCER. Kozbagarov, S. G.; Felker, A. Ya. (Aktyubinskij Meditsinskij Inst. (USSR)). Vestn. Dermatol. Venerol.; No. 11, 83-84(Nov 1973). (In Russian).

The case of a patient with a non-healing ulcer in the hairy part of the head, which had appeared 18 years after x irradiation of a fungus infection was reported. The irradiation was carried out in four sessions; daily irradiation at doses of 475 R for a total surface dose of 1800 R. On the basis of the clinical picture, x radiographs of parietal and frontal bones, and the histological picture the following diagnosis was made: degeneration of the delayed x-ray ulcer into a III-IV stage squamous-cell cancer with keratinization. (tr-auth)

6316 RADIATION THERAPY: WHAT IS IT. Abramson, N. (Duke Univ., Durham, NC). S. Med. J.; 67: No. 11, 1333-1336(Nov 1974).

From 67th annual scientific meeting; San Antonio, TX (11 Nov 1973).

A brief overview of radiotherapy is presented. Four questions are raised and briefly discussed. First, what are radiations and how are they produced? Second, what do these radiations do; how do they interact with tissues? Third, what are the clinical applications of radiation; what are the dangers and pitfalls? Fourth, is anything accomplished, are patients really cured? Combined modes of therapy (radiation, drugs, and surgery) are discussed and complications are briefly mentioned. (ERB)

6317 POSSIBLE EFFECTS OF DIAGNOSTIC X-RAYS ON THE HUMAN EMBRYO AND FETUS. Gaulden, M. E. (Univ. of Texas Health Services Center, Dallas). J. Arkansas Med. Soc.; 70: No. 12, 424-435(May 1974).

There is an increasing number of reports in the news media about the dangers of medical radiation, especially to the embryo, which serve to make patients uneasy about x-ray examinations. This unease is in some cases leading to legal action against physicians. By extrapolating from data on experimental animals and human cells in vitro to the data available on human cells in vivo, we can not escape the conclusion that there is no absolutely safe dose of radiation, and, therefore, that the low diagnostic doses administered to human embryos and fetuses are capable of causing effects which may not be detectable at birth. Unquestionably, more data are needed to determine the level of risk, but one point is already obvious: no longer can we be intellectually or morally satisfied with using an irradiated infant's normal condition at birth as the end point of our investigation of low dose effects. Those of us associated with or in the medical profession must further reorient our thinking to accept the distinct possibility of adverse effects of diagnostic radiation on the human embryo. Physicians must continue to seek constantly an acceptable balance between the benefits to be derived from a given x-ray exam and the potential harm to the unborn child. (auth)

6318 RADIATION NECROSIS OF THE HUMERUS: A REPORT OF THREE CASES. Sengupta, S.; Prathap, K. (Malaya Univ., Kuala Lumpur, Malaysia). Acta Radiol., Ther., Phys., Biol.; 12: No. 4, 313-320(1973).

Three cases of radiation necrosis of the upper end of the humerus associated with the treatment of carcinoma of the breast are presented. The changes in the affected bone were probably caused by primary cellular damage. The appearances and differential diagnosis are discussed. (auth)

6319 RECTAL DAMAGE AND RECTAL DOSE IN THE RADIATION THERAPY OF THE CARCINOMA OF THE CERVIX. Sunayama, Yusei (Okayama Univ. (Japan). School of Medicine). Nippon Sanka Fujinka Gakkai Zasshi; 25: No. 8, 826-834(Aug 1973). (In Japanese).

Damage to the rectum due to radiation therapy using the loading method by the National Institute of Radiological Sciences (T. A. O. method) was studied in 377 patients with cervical cancer of the cervix uteri in the Department of Gynecology and Obstetrics, Okayama University. Eleven items concerning rectal damage were analysed by computer: As the early stage of rectal damage, the incidence of diarrhea and rectal tenesmus, and the relationship between rectal tenesmus and radiation dose to the rectum were analysed, and as the late stage of rectal damage, its frequency, age distribution, the relationship between rectal damage and classification by clinical findings, the onset time of hemorrhage from the rectum, the degree of hemorrhage, the relationship between the grade of hemorrhage and the rectal dose, the relationship between measurement dose to the rectum and the quantity of internal radiation, the relationship between the frequency of internal radiation and the rectal dose, and the relationship between radiation dose to A point and the rectal dose were analysed, respectively. The incidence of rectal tenesmus was 38.5%. Frequency and grade of diarrhea were increased by cobalt radiation. The incidence of rectal tenesmus was increased with radiation dose to the rectum. The frequency of rectal hemorrhage was 40.5%, which was slightly high rate. Rectal damage was induced within a year in 71.8%, and within two years in 93.5%. Fistula formation was recognized in 1.3%. Hemorrhage from the rectum appeared in 37.8% in less than 4,000 R, and in 48.3% in 4,001 - 5,000 R. In order to reduce radiation dose, the method of intrarectal measurement was devised. The largest exposed point was 8.5 ± 1.0 cm from the anus. The difference to the actual measurement value was ±0.5%. This was almost similar to the actual measurement value. (JA)

6320 CORRELATION OF LEUKEMIA MORTALITY RATES WITH ALTITUDE IN THE UNITED STATES. Eckhoff, N. D.; Shultis, J. K.; Clack, R. W.; Ramer, E. R. (Kansas State Univ., Manhattan). Health Phys.; 27: No. 4, 377-380(Oct 1974).

From published demographic data and leukemia mortality data, the leukemia mortality rate per 100,000 population/yr was correlated with altitude. The findings of this study indicate that the leukemia mortality rate increases with increasing altitude up to about 2000 ft elevation, but that above 2000 ft the leukemia mortality rate decreases significantly with increasing altitude. (auth)

Vertebrates

Refer also to abstract 6251.

6321 (BNL-19213, pp 3) ANALYSIS OF RADIATION CARCINOGENESIS DOSE-EFFECT CURVES. Baum, J. W. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

Analysis was made of published data on neutron induction of mammary tumors in rats. These data contained several unexplained features including: dose response relation of power function (D^x) with exponent less than one for data reported at 11 months post irradiation; a saturation of effectiveness for doses greater than about 50 rads; and a large (85%) effect at doses of only 10 to 12 rads for a lifetime study. A mathematical model was developed which correctly predicts both the dose and kinetic (time) response following acute neutron irradiations. The model postulates a multi-event process for induction. Analysis of natural incidence vs. time indicates these events occur one at a time for naturally induced tumors. For neutron induced tumors, the analysis of incidence vs. time indicates that two events occur simultaneously during irradiation. Microdosimetric considerations dictate that for neutron induced tumors the simultaneous events are associated with a single particle or track. The shape of the dose-effect curve varies with time of analysis after irradiation. The model provides a logical framework to explain not only the rat data, but also the power function dose-effect relations observed previously in the analysis of Japanese cancers in survivors of Hiroshima and Nagasaki. (auth)

6322 (ORO-3882-13) MECHANISM OF RADIATION EFFECTS ON THE TRANSPORT AND BIOELECTRIC PROPERTIES OF RAT INTESTINE. Final Progress Report, January 1, 1969–June 30, 1974. McKenney, J. R.; Feldman, E. B. (Medical Coll. of Georgia, Augusta (USA)). 1974. Contract AT(40-1)-3882. 9p. Dep. NTIS $4.00.

Data were obtained on glucose uptake by the rat jejunum in normal rats, irradiated rats, rats with bile fistula, irradiated rats with bile fistula, normal rats treated with colestipol, and irradiated rats treated with colestipol. Glucose uptake was significantly decreased in irradiated, colestipol-treated rats. Uptake was significantly increased in bile fistula animals. Effects of bile salts on glucose uptake were also studied. (HLW)

6323 INVESTIGATION ON THE PHARMACOKINETICS OF SULFATHIAZOLE IN THE ACUTE RADIATION SYNDROME OF RATS. Krysicka-Doczka, H.; Danysz, A.; Wierzba, K.; Koter, T. (Instytut Lekow, Warsaw (Poland). Zaklad Farmakologii). Strahlentherapie; 147: No. 6, 634-642(Jun 1974). (In German).

5 figs., 10 refs.

Changes in the serum sulfathiazol level of irradiated rats were investigated. Sulfathiazole was determined together with its N-metabolites. The influence of irradiation with 600 R on the sulfathiazole level in serum and urine of white rats was examined. The sodium salt of sulfathiazole was given in a dose of 40 mg/kg. The course of the radiation syndrome was judged on the 30th day of observation by the survival rate, change of the body weight and the leucocyte count in the peripheric blood. In irradiated rats on changes of the serum sulfathiazole level (and the N-metabolites) were found, the excretion velocity and the half-life period, however, are slightly reduced. At the same time, the excretion of sulfathiazole and its metabolites by urine increases. The results prove that the radiation syndrome in rats does not lead to significant changes in the pharmacokinetics of sulfathiazole (or sulphonamides in general). In respect of these findings the standardized dosage of sulfonamides in an irradiated organism can possibly be maintained. (auth)

6324 EVALUATION OF THE RADIATION-PROTECTIVE INFLUENCE OF DIANABOL, TRASYLOL AND CYSTEAMINE IN FRACTIONATED IRRADIATION. Kocmierska-Grodzka, D. (Akademia Medyczna, Bialystok (Poland). Zaklad Farmakologii); Daniluk, J.; Radwan, J. (Akademia Medyczna, Bialystok (Poland). Radiobiologisches Forschungszentrum). Strahlentherapie; 147: No. 6, 628-633(Jun 1974). (In German).

4 figs., 15 refs.

The radiation-protective effect on Dianabol, Trasylol and cysteamine was tested under various schemes of fractionated irradiation and application of Dianabol. Under continuous irradiation (until the death of the laboratory animals) Dianabol showed no radiation-protective effect. It was demonstrated that Dianabol and Trasylol by only one prophylactic application exert an evident but moderate radiation-protective effect on the animals after 5 exposures to 150 R. (auth)

6325 INFLUENCE OF PHOSPHORORGANIC RADIOPROTECTIVE DRUGS ON POSTIRRADIATION CHANGES OF REACTIVITY TO BARIUM CHLORIDE IN GUINEA PIG INTESTINE. Wisniewski, K.; Zawadzka, E.; Kocmierska-Grodzka, D. (Akademia Medyczna, Bialystok (Poland). Zaklad Farmakologii). Strahlentherapie; 148: No. 1, 107-115(Jul 1974).

6 figs., 27 refs.

Examinations were carried out to determine postirradiation disturbances of reactivity to barium chloride in guinea pig intestine with animals receiving Fenchlorfos and Trichlorfon phosphororganic radioprotective drugs. Fenchlorfos and Trichlorfon effected modification of intestine reactivity to barium chloride and other metabolic disturbances in the intestine tissue of control animals. Some effects of the above compounds (especially the influence on intestine reactivity and content of calcium in tissue) are analogous to changes evoked by irradiation. It is, therefore, radiomimetic action. The examined phosphororganic compounds administered before irradiation decreased or normalized the majority of biochemical postirradiation disturbances and changes of intestine reactivity to barium chloride. This reflects a remarkable radioprotective effectiveness of those substances. (auth)

6326 INTESTINAL ABSORPTION MODIFICATIONS INDUCED IN PIGS BY ACUTE IRRADIATION. Remy, J.; Daburon, F.; Villiers, P. A.; Chenut, M. C.; Nizza, P. (CEA, 78-Jouy-en-Josas (France). Lab. Etable de Radiobiologie Appliquee). Strahlentherapie; 148: No. 1, 95-106(Jul 1974). (In French).

6 figs.; 5 tabs.; 21 refs.

Sodium, glucose, and calcium absorption was studied in pigs during the gastrointestinal syndrome, induced by γ exposure (1,500 rd), and in partially shielded irradiated pigs (800 rd). In the former lot, there first occurred inhibition of absorption within a few minutes after exposure. In the later one, malabsorption occurred later, and a trend toward recovery of sodium and glucose absorption was noticed one week later, whereas calcium malabsorption lasted several months. These results are discussed taking into account the present knowledge on the pathogenic data of the irradiation syndrome. (auth)

6327 STUDIES ON THE RADIOPROTECTIVE EFFECTS OF PHOSPHORORGANIC COMPOUNDS COMBINED WITH SUBSTANCES OF DIFFERENT ACTIVE CENTRES AND ACTION MECHANISMS. Panek, R.; Mackowiak, J.; Sarosiek, W.; Szymanski, A.; Wisniewski, K. (Akademia Medyczna, Bialystok (Poland). Zaklad Farmakologii). Strahlentherapie; 148: No. 1, 116-119(Jul 1974).

3 figs.; 14 refs.

The radioprotective effects of phosphororganic compounds combined with cysteamine and Dianabol were studied in 490 male Wistar rats that were irradiated with x rays at a dose rate of 22.5 R/min. Radioprotective effects, as evaluated by the survival rate, were obtained in animals treated with phosphororganic compounds combined with Dianabol and cysteamine. The dose reduction factor (DRF) amounted to 1.60 after Trichlorfon and cysteamine were given simultaneously, whereas after Fenchlorfos plus Dianabol it was 1.72. The importance of a properly chosen dose is stressed because otherwise the toxic effects may cumulate. (GE)

6328 EFFECT OF LOW-LEVEL RADIATION ON FRUCTOSE, GLYCOGEN AND PHOSPHORYLASE OF THE PECTORALIS MAJOR MUSCLE OF RODENTS. Chinoy, N. J.; Kshatriya, A. M. (Gujarat Univ., Ahmedabad (India). Dept. of Zoology). Strahlentherapie; 147: No. 6, 670-673(Jun 1974).

2 tabs.; 33 refs.

A biochemical study was carried out on some metabolites and an enzyme of the glycolytic pathway in pectoral muscles of normal irradiated and recovering rodents. Low-dose radiation did not impair muscle metabolism. The results showed a correlation between glycogen and phosphorylase activity with enhanced utilization of glycogen by the muscle. Fructose concentrations increased in mice during the recovery phase while in rat, its recovery was almost complete. The results are discussed in the light of physiological functions of x-irradiated muscle. (auth)

6329 ACTION OF X RAYS ON AMMONIA FORMATION IN THE KIDNEY AND EXCRETION IN THE URINE. Minasyan, G. M.; Oganesyan, A. S. (Inst. of Biochemistry, Erevan). Biol. Zh. Arm.; 27: No. 5, 93-94(May 1974). (In Russian).

A short-term whole-body x irradiation (700 R) increased the ammonia excretion in the urine of white rats as a result of increased ammonia formation. This ammonia is formed from the free amino acids of the blood, which are increased by the irradiation. Among the products which increase is glutamine, which is especially significant in ammonia formation. (MG)

6330 THE INFLUENCE OF VARIATION OF THE DAILY RHYTHM OF EXPOSURE UPON THE MAGNITUDE OF BIOLOGICAL EFFECTS: A COMPARISON OF X-RAY IRRADIATION AND CARBON DISULPHIDE INTOXICATION. Wronska-Nofer, Y.; Knobloch, K. (Instytut Medycyny Pracy w Przemysle Wlokienniczym i Chemicznym, Lodz (Poland)). Bull. Acad. Pol. Sci., Ser. Sci. Biol.; 20: 813-819(1972).

The magnitude of biological effects of carbon disulphide and x rays when applying the same total exposure at varying rhythms was investigated. Two different rhythms of exposure were applied: A – in the "daily" exposure rats were exposed to carbon disulfide vapor (0.96 mg/l) for 2.5 h daily over 8 months or were irradiated with a dose of 50 R daily over 5 weeks and the exposure was kept in both cases for 6 consecutive days of each week; B – in the "intermittent" exposure rats were exposed to vapors of carbon disulfide (0.96 mg/l) for 5 h daily, over 8 months or were irradiated with dose of 100 R daily over 5 weeks and in both cases the exposure was kept for 3 consecutive days of each week, followed by 4 free of exposure days. The magnitude of biological effects of both factors was assessed basing on the concentration of blood lipids, the rate of synthesis of cholesterol in liver and the excretion of N^1-methylnicotinamide in urine; additionally in x irradiated animals the total white cell count in the peripheral blood was made. The magnitude of effects depended on the rhythm of exposure. The "intermittent" exposure involved deeper disturbances. No explanation of this fact can be offered yet. (auth)

6331 CHANGES IN THE CIRCADIAN RHYTHM OF CALCIUM LEVEL IN THE BLOOD SERUM OF MICE EXPOSED TO UV AND X RADIATIONS. Zatorska, B. (Uniwersytet Jagiellonski, Krakow (Poland)). Acta Biol. Cracov., Ser. Zool.; 15: 183-191 (1972).

The circadian rhythm of calcium level in the blood serum of mice was considerably altered by uv and x rays. Exposure to uv resulted in the increase of Ca^{2+} in the mouse serum with the maximum occurring at 24:00. The lowest concentration of calcium was recorded at 12:00. The difference between the extremum values amounted to 3.5 mg%. Exposure to x rays led to a considerable decrease of calcium level in serum as demonstrated by the determination at 24:00. Quantitative determinations of calcium were carried out by a micromethod of Biering (after Homolka 1958). (auth)

6332 EFFECT OF UV RADIATION ON CHANGES IN THE CIRCADIAN RHYTHM OF CALCIUM LEVEL IN THE BLOOD SERUM OF MICE IN PARABIOSIS. Fialkowska, M. (Uniwersytet Jagiellonski, Krakow (Poland)). Acta Biol. Cracov., Ser. Zool.; 15: 167-173(1972).

Circadian rhythmic changes of calcium level in serum were determined in mice that had been surgically joined. One of the parabiotic animals was irradiated with uv light at the wavelength of 245–405 nm, while the partner was shielded. The diurnal rhythm of calcium was found to be present in both mice. The non-irradiated animal preserved a normal circadian rhythm. In the irradiated partner a shift in the rhythm occurred and the maximum values were recorded 13 hours after exposure. Despite the existence of common blood circulation and joined peritoneal cavities the informations on the stress stimulus (uv irradiation) were not transferred to the second individual. This suggests that uv light acts on the organism through the central nervous system. (auth)

6333 SEASONAL CHANGES OF RADIOSENSITIVITY IN MICE. Darenskaja, N. G.; Kuznecova, S. S.; Pravdina, G. M.; Ezova, V. M. Radiobiol.-Radiother.; 15: No. 3, 399-407(1974). (In German).

The investigation was carried out on pure-bred male mice 2 to 3 months of age. During the period of 1970 to 1971 the animals were examined every month with respect to a series of parameters and then irradiated with a ^{60}Co gamma unit with doses of 300 to 800 R. $LD_{50/30}$ was found to vary in about two phases by an annual average value (499 R) and that from maximum values in March (614 R) and August (688 R) to minimum values in February (360 R) and May (345 R). In nearly all parameters studied the condition of the organism changed in two phases in the course of the year. Comparing the seasonal fluctuations of these parameters to the corresponding changes of $LD_{50/30}$ a positive correlation of radiosensitivity with the leukocyte count in the blood, with the weight of spleen, and the number of bacteria of the skin's own flora as well as a negative correlation with the hemoglobin content in the blood were found. (auth)

6334 ANALYSIS OF TUMOR TRANSFORMATION OF TISSUES. IV. On the Chromosome Aberrations During Blastomogenesis. Salyamon, L. S.; Chernina, L. A. (Inst. of Cytology, Leningrad). Tsitologiya; 16: No. 10, 1275-1283(Oct 1974). (In Russian).

A number of features characterizing the relative irresponsiveness of tumor cells suggest the increased frequency of chromosome aberrations during blastomogenesis to be the result of a weakened ability of the cell to repair damaged genetic structures. Since the irresponsiveness appears in the pre-tumor period i.e., soon after the effect of cancerogenic substances on tissue, the ionizing radiation was expected to induce chromosome

aberrations with greater frequency in tissues which had previously been affected by cancerogenic substances. This has been confirmed in experiments on mice exposed to the action of cancerogenic hydrocarbons (DMBA or benzpyrene) and to a whole-body radiation. (auth)

6335 LONG TERM LIVER RADIATION DAMAGE IN THE RAT FOLLOWING INTERNAL AND EXTERNAL IRRADIATION. Waller, A. R.; Wordsworth, O. J. (Queensland Inst. of Tech., Brisbane). Aust. J. Exp. Biol. Med. Sci.; 52: 387-395(Apr 1974).

Liver radiation damage has been assessed and compared in the rat following two different liver irradiation regimes. (i) One group of rats received liver radiation doses ranging from 4,250 rads to 8,500 rads delivered externally in fractionated doses over 11 days by a 240 kV x-ray machine. Liver damage was assessed by determining serum levels of alanine aminotransferase, aspartate aminotransferase, and total hemolytic complement. (ii) A second group of rats received a liver radiation dose of 8,500 rads delivered internally via intravenously injected radioactive colloidal gold-198, and similar serum parameters were studied. Liver histology was also carried out on both groups of rats. Both treatments result in abnormal serum levels of enzymes and complement, and a comparison of results for both irradiation regimes indicates that, while there are slight differences in early response, particularly in serum complement levels, nevertheless similar long term liver damage results. (auth)

6336 HISTAMINE AND ANTIHISTAMINES. Schachter, M. (Ed.). International Encyclopedia of Pharmacology and Therapeutics, Section 74. Elmsford, NY; Pergamon Press, Inc. (1973). 194p. $15.50.

A separate abstract was prepared for one of the chapters (Histamine as Protector Against Ionizing Radiation). The other chapters discuss receptors for histamine, histamine release by drugs and chemicals, histamine release by antigen-antibody reactions, effects of drugs on brain histamine, and antihistamine drugs. (ERB)

For an abstract of an individual chapter see: 6337.

6337 HISTAMINE AS PROTECTOR AGAINST IONIZING RADIATION. Bacq, Z. M. (Univ., Liege). pp 109-125 of Histamine and Antihistamines. Schachter, M. (ed.). Elmsford, NY; Pergamon Press, Inc. (1973).

Histamine protects mice and rats against the effects of exposure to irradiation mainly because it decreases the oxygen pressure in the tissues. Other mechanisms of action are not excluded. The liberation of endogenous histamine after exposure to ionizing radiation is not an important factor in the physiopathology of radiation sickness. (auth)

6338 COMBINED EFFECTS OF MIRACIL-D AND RADIATION ON MOUSE EMBRYOS. Michel, C. (Univ., Zurich). Experientia; 30: No. 10, 1195-1196(15 Oct 1974).

The combined treatment with Miracil-D and x radiation of 8-day-old mouse embryos led to an increased rate of malformations. It was seen that the effect was not additive, but rather synergistic between the two agents. (tr-auth)

Invertebrates

Refer also to abstract 6274.

6339 (UCR-34P105-27) SOME RADIATION EFFECTS ON SEGREGATION IN DROSOPHILA. Parker, D. R.; Williamson, J. H. (California Univ., Riverside (USA). Dept. of Biology). 1973. 21p. Dep. NTIS $4.25.

Translocation induced in the immature oocyte of Drosophila in meiotic prophase affects division I orientation and segregation, the usual result being that the two halves of translocations are directed to opposite poles. Since interchange is usually (if not exclusively) between chromatids, this is to be expected from the creation of illegitimate conjunctions. Good agreement is obtained between patterns of segregations deduced from recovered half-translocation bearing exceptions and the kinds of disomic gametes expected as alternative recoveries from the same division I configurations. Inferences drawn from the study of compound-X females have been found to apply as well in the case of females of normal karyotype. Numerical errors occur predominantly, possibly exclusively, in division I. The rate of induced nondisjunction of specific chromosome pairs varies in relation to the structure of the entire complement, as required if x radiation-induced nondisjunction is interchange dependent, but which would be unexpected if the mechanism involved effects on individual spindle fibers, chromosomes, or chromosomal bivalents. (auth)

6340 MORPHOSES OF ANTENNA AND SOMATIC MOSAICISM IN DROSOPHILA MELANOGASTER R(1;3)05/y sn; D/ss^a. Ginter, E. K.; Ivanov, V. I.; Mglineta, V. A. (Inst. of Medical Genetics, Moscow). Genetika; 10: No. 9, 64-70(Sep 1974). (In Russian).

Duplication of antennal structures and the features of irradiation-induced somatic mosaicism in females of Drosophila melanogaster T(1;3)05/y sn; D/ss^a were studied. In about 0.3% of these females spontaneous duplications of derivatives of antennal imaginal discs were observed. Following irradiation of early larval stages the frequency of these morphoses sharply increased (up to 20%) and then lowered down to the control level when 75 to 95 hrs larvae were irradiated. The degree of development of additional antennal structures was independent of the larval age at irradiation. The frequency of mosaic spots following irradiation of 35-, 55-, and 75-hrs larvae was 0.59, 0.42, and 0.97%, respectively. Following irradiation of 95-hrs larvae the frequency increased up to 2.8%. Phenotypically, the majority of spots induced before 95-hrs of development were "y", and only at 95-hrs the proportion of "y sn" spots increased significantly. These results may be due to cellular lethality of heterozygous deletion in the 3rd chromosome of crossover cells y sn/y sn; D/ss^a up to 95-hrs, i. e., up to the time of regional determination of cells of the antennal discs, after which the manifestation of cellular lethal becomes non-autonomous. (auth)

6341 SPECTRA OF VIABILITY MUTATIONS OBTAINED IN THE X-CHROMOSOME OF DROSOPHILA MELANOGASTER AS A RESULT OF TREATMENT OF MALES WITH N-NITROSOETHYL UREA AND GAMMA RAYS. Mitrofanova, G. L. (Inst. of Chemical Physics, Moscow). Genetika; 10: No. 9, 88-93(Sep 1974). (In Russian).

The article comprises the results of the investigation of the viability mutations in F_2 obtained as the result of the treatment of Drosophila melanogaster males of the strain D-32 with N-nitrosoethyl urea (NEU) at a concentration of 24 mg in a 1.5l excator during 47 hours and with gamma rays at 6000 R and 550 R/min doses. Recessive lethals as well as all the other types of mutations affecting viability were detected by the M-5 method, the ratio of the number of grey males to the number of grey females (i.e., viability) being determined for each culture. On the basis of these data, curves of distribution of cultures with respect to viability were plotted. The peak of the irradiation curve coincided with that of the control curve and lay within the interval of 84 to 104%. The peak of the NEU curve is shifted with respect to that of the control curve and lies within the range of 63 to 83%, which is the evidence of a decrease of viability. The second maximum lies within the range of 0 to 20%, its height being 32.8% for NEU and 10.00% for gamma irradiation; in the control curve the second peak is lacking. The frequency of full lethals in the X-chromosome of Drosophila melanogaster was 22.34% and 4.67% in the variants with NEU and with gamma irradiation respectively. The frequency of sublethal mutations in the X-chromosome of Drosophila melanogaster was 14.96% and 6.67% in cases of NEU treatment and gamma irradiation respectively, being 1.04% in the control. In case of NEU treatment the total proportion of chromosomes in which hereditary changes decreasing the viability were induced exceeded 50%. Among 488 cultures studied in the variant with NEU treatment, two cultures were found with a very high ratio of grey males to grey females, i.e., in which the viability was increased. (auth)

6342 POSSIBILITIES OF APPLYING RADIATION STERILIZATION IN THE CONTROL OF THE CHERRY FRUIT FLY (RHAGOLETIS CERASI L.). Burov, D.; Genkova, M. Gradinar. Lozar. Nauka; 10: 15-21(1973). (In Bulgarian).

Two-year studies showed a ratio of nearly 1:1 between females and males of the cherry fruit fly in the Sofia environment. Parthenogenesis was ascertained. Copulation and feeding of the flies began under laboratory conditions on the second day after imagination. Both sexes are polygamous and copulate from 1 to 9 times. Several days prior to imagination gamma rays treatment of pupae with a dose of 7500 r (produced by a ^{60}Co source of 1350 r/minute) induced sterility in both sexes. Irradiated flies had nearly an equal length of life as the controls, and copulated from 1 to 8 times. (auth)

6343 VIABILITY AND USE OF SPERM AFTER IRRADIATION OF THE LARGE MILKWEED BUG. Riemann, J. G.; Thorson, B. J. (Dept. of Agriculture, Fargo, ND). Ann. Entomol. Soc. Amer.; 67: No. 6, 871-876(Nov 1974).

The effects of 10 to 75 krad of gamma irradiation on sperm viability and usage in Oncopeltus fasciatus (Dallas) were studied by observations on sperm quantity and activity, fertilization levels, and hatch of eggs from females mated to both irradiated and non-irradiated males. Sperm treated in the male and then transferred to the female appeared most affected by irradiation. Rapid loss of motility and disappearance from female's spermathecae occurred

when sperm were treated with the higher doses of radiation, but at doses near the sterilizing level sperm quantity and activity were near the control level for some time after transfer of the treated sperm during mating. Even at lower doses, however, fertilization levels fell off more rapidly than in the controls. This drop in fertilization levels was greatly accelerated when the females with treated sperm were remated to castrated males. The most sensitive indicator of nongenetic damage to sperm was the effect on displacement with repeated mating. Irradiated sperm received from a 1st mating were largely displaced by a 2nd mating to an untreated male. Less sperm displacement occurred in the reverse mating sequence. (auth)

Radionuclide Effects (Internal Source)

Refer also to abstract 5969.

Man

Refer also to abstracts 5964, 5965, 5988, 5990, 6256, 6297, 6303, 6367–6369, and 7449.

6344 (ORNL-4979, pp 1-4) TABULATIONS OF ABSORBED DOSE PER MICROCURIE-DAY RESIDENCE OF VARIOUS RADIONUCLIDES IN SOURCE ORGANS OF AN ADULT. Snyder, W. S.; Ford, M. R.; Watson, S. B. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Methods are discussed that were used for computer calculations of the average dose equivalent in some 20 target organs per microcurie-day of activity in the source organ. Estimates of total dose for approximately 100 radionuclides of particular interest in nuclear medicine and for a larger number of radionuclides, perhaps 400 to 500, of interest in environmental studies will be given, for which separate listings of dose will be included for each type of radiation. The tabulated values are the dose equivalent imparted to the target organ for 1 μCi-day in the source organ and correspond in principle to the effective energy values used in computing dose and/or maximum permissible concentration (MPC) values recommended at the present time by the National Committee on Radiation Protection (NCRP) and the International Commission on Radiological Protection (ICRP). This effective energy is the weighted energy absorbed in an organ per disintegration of the radionuclide, the weighting factors being those related to the biological effectiveness of the radiation, the linear energy transfer (LET), or other conditions of exposure. Thus the tabulated quantity may be used to obtain dose equivalent in the target organ by a simple formula. (CH)

6345 (ORNL-4979, pp 5-11) REVISION OF MIRD PAMPHLET NO. 5 ENTITLED "ESTIMATES OF ABSORBED FRACTIONS FOR MONOENERGETIC PHOTON SOURCES UNIFORMLY DISTRIBUTED IN VARIOUS ORGANS OF A HETEROGENEOUS PHANTOM". Snyder, W. S.; Ford, M. R.; Warner, G. G. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

MIRD Pamphlet No. 5 presents estimates of absorbed fractions for 12 monoenergetic photon sources distributed uniformly in some 16 different body organs of a mathematical phantom simulating a human adult. These estimates were made for dose estimations in patients following radionuclide administration with a Monte Carlo computer code designed to take account of: the geometrical shape of the body and of the major internal organs; the different densities and compositions of the various tissues of the body, especially of the skeleton and lungs; and the multiple scattering of photons in the body. New computer runs have been made, and the revision of MIRD Pamphlet No. 5 has been drafted. (auth)

6346 (ORNL-4979, pp 13-16) DOSE TO A DYNAMIC BLADDER FOR ADMINISTERED RADIONUCLIDES. Snyder, W. S.; Poston, J. W.; Warner, G. G.; Owen, L. W. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The urinary bladder is one of the more dynamic of the body organs in that it undergoes marked changes in size during the course of a filling, and the dose per disintegration of a nuclide present in urine may change by an order of magnitude as the volume of urine increases. The dose is thus affected by the schedule of voiding, by the rate of formation of urine, by the biological rates of elimination of the radionuclide, and by the decay scheme of the radionuclide. It has been shown that substantial reductions in dose are possible if one can optimize on these parameters. There may be cases where reduced dose would not be possible without interfering with the clinical regime, but frequently this is not the case. The bladder is represented as an ellipsoid which preserves its shape as it fills. The mass of the bladder walls is taken as 45 g, and the volume of urine may vary from 0 to 500 ml. Assuming that a source of photons is distributed uniformly in the urine content, Monte Carlo calculations were used to determine the dose per photon for seven volumes of urine. The dose per photon can be approximated by a sum of two exponentials with the urine volume as the independent variable. The doses have been computed for each of 12 photon energies ranging from 10 keV to 4 MeV. The coefficients and exponential factors vary with energy. A computer code was written which can be used to compute the dose for an arbitrary filling with the activity entering the bladder at an arbitrary exponential rate. A sum of such exponentials can represent most elimination patterns that have been observed. Results of calculations of the radiation dose absorbed in the bladder wall from ^{99m}Tc-pertechnetate and ^{133}I present in urine are presented. (CH)

6347 (ORNL-4979, pp 17-26) INTERNAL DOSIMETRY OF SPONTANEOUSLY FISSIONING NUCLIDES. Dillman, L. T.; Jones, T. D. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The radiation hazard associated with radionuclides that decay partly by spontaneous fission was investigated. It is pointed out that even if a nuclide decays via spontaneous fission only 1% of the time, the associated dose will be comparable with or larger than the dose due to all other modes of decay. Since approximately 80% of the energy emitted in fission occurs as kinetic energy of the fission fragments, the source organ will absorb a major portion of the total emitted radiation. However, for the gastrointestinal (GI) tract, the fission fragments fail to penetrate the mucosa to an appreciable extent. In this case the neutron, γ, and β radiations associated with fission are responsible for an appreciable fraction of the dose to the GI tract walls. Methods are described for calculating the radiation dose to the walls of the GI tract due to spontaneous fission of ^{252}Cf, ^{238}U, and ^{244}Cm. Monte Carlo computer calculations were made using a human phantom. (CH)

6348 (ORNL-4979, pp 33-39) MEASUREMENT OF ABSORBED FRACTIONS FOR PHOTON SOURCES DISTRIBUTED UNIFORMLY IN VARIOUS ORGANS OF A HETEROGENEOUS PHANTOM. Garry, S. M.; Stansbury, P. S.; Poston, J. W. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Monte Carlo calculations provide a direct and accurate means of determining the γ-ray energy deposition in phantoms from internal emitters. Formulation of Monte Carlo results into absorbed fractions and specific absorbed fractions allows direct calculation of the average γ dose delivered to a given target region or to a point region respectively. Extensive tables of absorbed fractions and specific absorbed fractions applicable to bounded tissue regions containing point- or uniform-source distributions of radioactivity have been published. There are two limitations on the accuracy of Monte Carlo results: the statistical uncertainty due to sampling variation, and the adequacy of the mathematical model being sampled as a representation of the physical processes involved. The number of photon histories followed in the Monte Carlo calculation may be the limiting factor for statistical uncertainty, for example, when source and target organs are small and are separated by an appreciable distance. A program is described that was undertaken to design and construct a physical representation of the Snyder-Fisher heterogeneous mathematical phantom (based on reference man); determine dose distributions within the phantom resulting from photon emitters uniformly distributed in selected organs; utilize these dose distributions to determine absorbed fractions; and compare these experimentally determined absorbed fractions with the results of Monte Carlo calculations. (CH)

6349 (ORNL-TM-4735) ESTIMATED RADIATION DOSES FROM FOOD COOKED WITH NATURAL GAS FROM NUCLEARLY STIMULATED WELLS. Barton, C. J. (Oak Ridge National Lab., Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 7p. Dep. NTIS $4.00.

Published data on the transfer of tritium from nuclearly stimulated natural gas to food during cooking and the average volume of gas used in gas ranges have been combined to provide an estimate of the potential tritium intake by people in the United States eating hypothetically tritiated food. The average whole-body dose to an individual is estimated to be 0.02 millirem/year, and the corresponding population dose to 100 million people is 2×10^3 man-rems, about 1/5000 of the dose received by the same population from natural radiation sources. This exposure pathway

appears to be less important than direct exposure to tritiated water vapor in natural gas combustion products. (auth)

6350 A SIMPLE METHOD FOR THE EVALUATION OF INTERNAL DOSES IN NUCLEAR MEDICINE. Conte, L.; Mombelli, L.; Vanoli, A. (Milan Univ. (Italy). Istituto di Scienze Radiologiche). Nucl.-Med.; 13: No. 2, 193-206(Aug 1974).

4 figs.; 4 tabs.; 9 refs.

A method to be used in the field of nuclear medicine, for calculating internally absorbed doses in patients is presented. The simplicity and flexibility of this method allows one to make a rapid estimation of rick both to the individual and to the population. In order to calculate the absorbed doses, the procedure is based on the concept of the mean absorbed fraction, taking into account anatomical and functional variability, which is highly important in the calculation of internal doses in children. With this aim in mind, tables were prepared that take into consideration anatomical differences and that permit the calculation of the mean absorbed doses in the whole body, in the organs accumulating radioactivity, in the gonads and in the marrow; all this for those radionuclides most widely used in nuclear medicine. By comparing the results with dose obtained from the use of M.I.R.D.'s method it can be seen that when the errors inherent in these types of calculation are taken into account, the results of both methods are in close agreement. (auth)

6351 RECENT ADVANCES IN DOSIMETRY FOR NUCLEAR MEDICINE. Cloutier, R. J.; Watson, E. E. (Oak Ridge Associated Universities, Oak Ridge, TN). Trans. Amer. Nucl. Soc.; 19: 43-44(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6352 QUANTITATIVE HEALTH ESTIMATES OF TRANSURANIC RELEASES. Barr, N. F. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 73(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6353 TOXICITY OF THE TRANSURANIUM ELEMENTS WITH SPECIAL EMPHASIS ON PLUTONIUM. Stannard, J. N. (Univ. of Rochester, NY). Trans. Amer. Nucl. Soc.; 19: 73-74 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6354 ENVIRONMENTAL CONCERNS IN URANIUM MINING, MILLING, AND CONVERSION. Shelly, W. J. (Kerr-McGee Nuclear Corp., Oklahoma City, OK). Trans. Amer. Nucl. Soc.; 19: 211(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6355 RADIOCOLLOID ^{198}Au IN THE COMBINED TREATMENT OF THE BREAST CANCER. Volkova, M. A.; Borisov, E. A.; Pelman, S. G. (Gertzen Scientific Research Oncology Inst., Moscow). Radiobiol.-Radiother.; 15: No. 3, 365-368(1974).

The experiences using colloidal ^{198}Au for combined treatment of 170 mamma carcinomas of stages I to III are reported. Based on the colloid's tendency to remain at the place of injection and the limited range of beta particles in the tissue, the isotope was injected into the tumor, into the mammary gland tissue, and into the parenchyma of the axillary, subclavicular, and parasternal region. In order to obtain a more uniform irradiation of the axillary-subclavicular lymph-nodes, the radiocolloid was injected in 50 patients into a lymphatic vessel of the hand. The dynamic observation yields very favorable results of treatment. 66(71%) out of 93 patients of stage II and 14(45%) out of 31 patients of stage III were alive 5 years without clinical symptoms. Out of 60 patients with lymph-node metastases 28(46.7%) were alive without clinical symptoms, out of 66 patients without regional metastases 54(81.8%). The lack of severer general radiation reactions immediately after injection of the nuclide and also later on enables the interstitial injection of ^{198}Au for preoperative irradiation of mamma carcinoma also in those patients the general condition of whom being loaded by accompanying diseases (diabetes, tuberculosis and so on). (auth)

6356 PROTECTION OF THE HUMAN BODY AGAINST RADIOACTIVE IODINE INFLUENCE. Il'in, L. A.; Arkhangel'skaya, G. V.; Konstantinov, Yu. O.; Likhtarev, I. A. pp 174-257 of Radioactive Iodine in the Problem of Radiation Safety. Moscow; Atomizdat (1972). (In Russian)

13 Figs.; 15 tables; 230 refs.

The possibilities for protection against radioiodine in different stages of its metabolism were discussed. The general laws of the deactivation of the skin from different radioactive materials were studied. Questions on the effectiveness of the use of different preparations and pharmacological agents for the prophylaxis of the radiation effect of radioiodine were discussed. Every combination of the various measures was divided into two groups with consideration of the characteristics of the migration or radioiodine along the biological chain up to man (first group) and after entry into the organism or on open places of the skin covering (second group). The quantitative aspects of the protective effects of stable iodine in man were examined. (tr-auth)

6357 RADIATION HAZARDS AND PROBLEMS OF RATING IODINE RADIOISOTOPES. Il'in, L. A.; Arkhangel'skaya, G. V.; Konstantinov, Yu. O.; Likhtarev, I. A. pp 115-170 of Radioactive Iodine in the Problem of Radiation Safety. Moscow; Atomizdat (1973). (In Russian).

131 Refs.; 15 figs.; 16 tables.

The role of different radioisotopes in irradiation of the thyroid gland and dosimetric parameters for calculating the absorbed dose in inhalation intake were investigated. A transport scheme for iodine in the organism after inhalation and a scheme for calculating the radiation hazard of radioiodine in air are presented. Dose loads in critical organs are discussed, and possible levels of radiation activity in deposition of these isotopes in the organism under conditions of controlled discharge of ^{131}I to the atmosphere are discussed on emergency situations and for extreme circumstances. Medico-legal aspects of the hazard of incorporation of radioactive iodine in the diagnosis of malignant thyroid tumors are considered. Problems of standards for radioactive iodine content of the surroundings and of the human organism are discussed, and standards for radiation safety of iodine isotopes are calculated. (tr-INIS)

6358 ACTIVITY OF CHOLINESTERASE OF ERYTHROCYTE STROMATA IN URANIUM MINERS. Pehr, F.; Nosek, J. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia). Laboratorni Oddeleni). Cas. Lek. Cesk.; 112: No. 51, 1579-1582(21 Dec 1973). (In Czech).

In three groups of uranium miners with a different history of work underground, the activity of cholinesterase in erythrocyte stromata was studied. A significantly lower activity was observed in all three groups as against controls. A rapid drop in activity was found in the first group, i.e., of miners with the history of up to five years of work underground. In the other two groups the activity of cholinesterase constantly decreased, this at the level of the group of miners that had worked underground for five to ten years. The activity decrease was found not to be dependent on the physical age of miners. (INIS)

6359 NUCLEAR-FUELED CIRCULATORY SUPPORT SYSTEMS. IV. Radiologic Perspectives. Huffman, F. N.; Norman, J. C. (Texas Heart Inst., Houston). Transplant. Proc., Suppl.; 6: No. 1, 61-68(Sep 1974).

It seems that the benefits from totally implantable nuclear-fueled circulatory support systems are such that the possible somatic and genetic radiation effects to the patient, his family, his associates, and the general population do not constitute a deterrent to clinical application, within the context of risks normally assumed by society. The primary problem of large-scale deployment of radioisotope-powered circulatory support systems is that of ensuring fuel containment. If such fuel capsules can be developed, they will probably be of a vented design. These developments will entail a great deal more analysis, design, and testing. (auth)

Animals

Refer also to abstract 6335.

6360 INHIBITION OF FORMATION OF SPERMATOZOA OF KILLFISHES BRED IN TRITIUM SOLUTION. Egami, N. (Tokyo Univ.); Taguchi, Y. pp 6-17 of Investigation of the Effects of Low Concentrations of Radionuclides on Aquatic Life. Tokyo; Nuclear Safety Research Association (1973). (In Japanese).

This paper describes the experiment of the effect of radiation on the testes of killfishes bred in ^{3}H solution. Male killfishes in non-breeding season (less than 10°C water temperature) were bred with female killfishes in ^{3}H solution (0, 10^{-5}, 10^{-3}, 10^{-1} Ci/l) at 25°C. Five to 40 days after the initiation of treatment, the killfishes were fixed in Van Solution to calculate the proportion of the testis weight in body weight (GSI) and to prepare the tissue specimen of the testes. When transferred to the water with 25°C, GSI of control group increased from 0.7 to 0.9 for 5 to 10 days and then decreased to 0.6 till 30 days. On the other hand, the killfishes bred in 10^{-1} Ci/l did not show an increase in GSI, but showed a decrease according to time. Generative cells were affected in the concentra-

tion of more than 10^{-5} Ci/l. Next, the uptake of ^{3}H into the testis of killfish bred in 0, 10^{-5}, and 10^{-1} Ci/l of ^{3}H solution was measured. It was less than 100 dpm/mg in the control and 2400 dpm/mg for 3 to 10 days in the group bred in 10^{-5} Ci/l solution. In the fishes bred in 10^{-1} Ci/l, about 1000 dpm/mg was incorporated 1 day after the treatment and the uptake increased to 17,500 dpm/mg till 15 days. However, a remarkable small amount of ^{3}H was incorporated into the dry components of the testis in the control and the 10^{-5} Ci/l group except the 10^{-1}Ci/l group where 2,000 dpm was uptaken. Total absorbed dose was calculated from the amount of ^{3}H incorporated into the raw testis for 30 days. This experiment indicated that the radiation originated from ^{3}H affected the formation of spermatozoa and the growth of fishes, even if in an extremely small dose. (TD)

6361 EXPERIMENTAL STUDY OF THE COMBINED EFFECT OF URANIUM AND RADIUM ON THE BODY. Svyatkina, N. S.; Novikov, Yu. V. Gig. Sanit.; No. 8, 35-41(Aug 1974). (In Russian).

Experimental investigations on animals that received uranium and radium for a period of two years detected no changes in the majority of tests used. Histological examinations revealed morphological shifts(dystrophic, inflammatory, destructive, etc) in the mucous membrane of the gastrointestinal tract of animals. Taking into account the high level activity of alkali phosphatase in the blood serum and the fall of the weight of experimental animals after a prolonged chronic test, the changes noted, apparently, may be due to disturbances of the functioning of the gastrointestinal tract, as the result of prolonged combined effect of natural high concentrations of radium and uranium (the toxic action of uranium as a chemical element and, besides, the α irradiation of radium and uranium). (auth)

6362 RADIATION-INDUCED ZONING IN THE CYTOPLASM OF EARLY OOCYTES OF HETEROPNEUSTES FOSSILIS B LOCH. Rathi, S. K. (Radiation Biology Laboratory, University of Rajasthan, Jaipur (India)). Biologia (Bratislava); 28: No. 12, 997-1001(1973).

Two types of cytoplasmatic zones were observed in the perinucleolar stage oocytes and the yolk vesicle stage oocytes of Heteropneustes fossilis (Bloch) following irradiation. The fish were injected with a ^{60}Co chloride solution in dilute HCl. Ovaries were fixed in Bouin's fluid and 6-μ sections were stained. Two zones, one around the nucleus, called perinuclear, and the second at the periphery of oocyte and around the normal cytoplasm, called pericytoplasmic, were formed due to partial denaturation of the cytoplasm. (auth)

Plants

6363 EFFECT OF THO ON THE CHROMOSOMES. Tanaka, N. (Teikyo Univ., Tokyo); Kuroiwa, T. pp 33-43 of Investigation of the Effects of Low Concentrations of Radionuclides on Aquatic Life. Tokyo; Nuclear Safety Research Association (1973). (In Japanese).

The effect of ^{3}H-thymidine (TdR), ^{3}H-uridine (UR), ^{3}H-arginine (Arg), and tritium solution (THO) on the nuclei was comparatively investigated in meristem and non-meristem. Frequency of chromosome abnormality was used as an index. Crepis capillaris, the seed root of which was 3mm length 2 days after germination, was selected. They were transferred to THO, ^{3}H-TdR, ^{3}H-UR, ^{3}H-Arg, and the control solution and were fixed after 48 hours incubation. The part 600 μ from the tip of the root was the meristem and the part over that was the non-meristem. In the nuclei treated with low concentration (1 μ Ci/ml of ^{3}H), the abnormality frequency in the non-meristem was about 10% of that in the meristem. The frequency in the meristem was 4.1% in ^{3}H-TdR, 4.3% in ^{3}H-UR, 1.1% in ^{3}H-Arg, 3.3% in THO, and 0.08% in the control. While, in high concentration (10 μ Ci/ml of ^{3}H concentration), that was 7.9% in ^{3}H-TdR, 7.7% in ^{3}H-UR, 2.4% in ^{3}H-Arg, 5.4% in THO and 0.12% in the control and was two times that in the low concentration. Chromosome abnormality caused by chromosomal stickiness was observed in the meristem. Chromosome fractions, which were not existed in the daughter nuclei and remained in the cytoplasm, formed small nuclei. In non-meristem, a part of nucleus was separated from the nucleus itself and formed abnormally small nuclei. It was found that the absorbed ^{3}H physiologically and hereditically affected on the cells and nuclei. (JA)

Microorganisms

6364 RADIUM UPTAKE BY FRESH WATER ALGAE. Havlik, B. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)); Robertson, E. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). J. Hyg., Epidemiol., Microbiol., Immunol.; 17: No. 4, 393-405(1973).

The accumulation of radium by algae and its mechanism were studied in five species of green algae and two species of blue-green planktonic algae. Two series of experiments were conducted. In the first, radium was added only at the beginning of the experiment, and in the second, fresh medium containing the required radium concentration was continuously applied to the algae. The radium concentrations tested were from 10^{-7} to 10^{-9} Ci/l. Possible effects of ^{226}Ra on the algae were studied by measuring the photosynthetic oxygen production, total protein content, and growth activity. For the oxygen production experiments, algae were exposed to radium for 3 and for 24 hours. The iodometric and the electroreduction methods (Oxygraph) were used in oxygen measurements. The total protein content was measured with an Autoanalyzer unit after 3 weeks of cultivation in the radioactive medium. In four alga species, a radium concentration of 3×10^{-8} Ci/l decreased the oxygen production by about one third after an exposure of 24 hours. (auth)

Nuclide Kinetics and Toxicology

Refer also to abstract 5969.

Man

Refer also to abstracts 5990, 6256, 6303, 6350, 6353, 6357, 6397, and 8050.

6365 (AECL-4756) TOXICOLOGICAL ASSESSMENT OF ORGANIC REACTOR COOLANTS. Weeks, J. L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba. Whiteshell Nuclear Research Establishment). Jun 1974. 27p. Dep. NTIS (US Sales Only) $4.50. AECL $1.00.

The use of organic reactor coolants is briefly described and the published literature concerning the toxicology of these materials is reviewed. The investigations of hydrogenated terphenyl (HB-40) by the Department of Pathology, University of Manitoba, and by the Health and Safety Division, Whiteshell Nuclear Research Establishment are summarized and Maximum Permissible Concentrations for hydrogenated terphenyl in air and water are proposed. (auth)

6366 (ORNL-4979, pp 27-29) DOSIMETRIC DATA FOR LEAD. Bernard, S. R. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

A metabolic model for Pb uptake by blood from the GI tract was used, with data on baboons and reference man, to calculate the retention of ingested Pb in bones, liver, kidneys, blood, and other tissues. The validity of the model is compared with results of studies using ^{210}Pb and ^{212}Pb as tracers. (CH)

6367 ERYTHROCYTE CAPACITY OF BONDING URANYL IONS. Drazanova, S.; Nosek, J. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia). Laboratorni Oddeleni). Cas. Lek. Cesk.; 111: No. 44, 1364-1366(Nov 1973). (In Czech.).

The capacity in erythrocytes of bonding uranyl ions was investigated, aiming at the clarification of the dependence of the uranyl ion bonds on the concentration of uranyl salt and clarification of the erythrocyte capacity saturation. The amount of uranium bonded in erythrocytes increased with increasing concentration of uranyl salt in the suspension. The dependence was exponential and was only found valid up to a concentration of 4.4 μg U/ml. In dilute suspensions of uranyl salt, erythrocytes were found to bond uranyl ions also against the concentration gradient. Comparison of the data with the findings of a significantly increased content of uranium in the erythrocytes of uranium miners showed that the miners' erythrocytes had bonded ten times less uranium as had been their maximum bonding capacity. (INIS)

6368 CAPACITY OF URANIUM MINERS' ERYTHROCYTES OF BONDING URANYL IONS. Drazanova, S.; Nosek, J. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia). Laboratorni Oddeleni). Cas. Lek. Cesk.; 111: No. 44, 1366-1369(Nov 1973). (In Czech.).

The capacity of uranium miners' erythrocytes to bond uranyl ions was studied in vitro. In the experiment, erythrocyte samples were used of miners working underground for less than 10 years and of miners working underground for 10 years and more. Uranium miners' erythrocytes in vitro were ascertained to have lower capacity of bonding uranyl ions than erythrocytes in controls. The differences were significant with all five concentrations of uranyl salt used. Significant differences were also found

between the two experimental groups of uranium miners' erythrocytes, varying with the concentration of uranyl salt. The reduced bonding capacity of erythrocytes is attributed to the fact that erythrocytes in uranium miners in vivo bond a certain amount of uranyl salt, which reduces their bonding capacity in vitro. The difference is also due to the fact that uranium miners' erythrocyte stromata in vivo gradually change their average biological structure and this alters their capacity in vitro. The actual amount of uranium found in uranium miners' erythrocytes was approximately 40 times smaller than would correspond to the maximum capacity of erythrocytes of bonding uranyl salt. (INIS)

6369 HEAT HEMOLYSIS IN SUSPENSION OF URANIUM MINERS' ERYTHROCYTES. Nosek, J. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia). Laboratorni Oddeleni). Cas. Lek. Cesk.; 112: No. 45, 1395-1398(Nov 1973). (In Czech.).

Heat hemolysis in vitro of erythrocytes of uranium miners was studied. At 56°C, hemolysis of erythrocyte suspensions was significantly smaller as against controls. This difference reduced with the duration of the uranium miners' work underground. The resistance is believed to be due to an increased content of uranium in uranium miners' erythrocytes, which, up to a certain point, increases the activity of the pentose cycle of glucolysis. (INIS)

6370 INDEX OF RISK FOR INHALATION HAZARD EVALUATION. Ramu, M. C. S. (Bhabha Atomic Research Centre, Bombay). Health Phys.; 27: No. 4, 353-358(Oct 1974).

The increasing use of nuclear reactors for power generation and developments of facilities for the production of nuclear materials, fuel fabrication, and fuel reprocessing may result in a large number of potentially hazardous situations. This necessitates rapid development of aerosol inhalation study programs since a satisfactory knowledge of the various factors involved in the evaluation of inhalation risk is still deficient. A study of the dependence of the deposition of aerosol particles in the human lung on the tidal volume, the breathing frequency, and the expiratory reserve volume becomes very significant in the evaluation of aerosol inhalation risk. This paper describes a new approach for minimizing inhalation risk due to breathing of aerosol particles in industries. The concept of proper choice of personnel in industries, with due consideration to respiratory parameters, has been suggested, and an index of inhalation risk has been evaluated for this purpose. (auth)

6371 EXCRETION OF ^{241}Am AND ^{244}Cm FOLLOWING TWO CASES OF ACCIDENTAL INHALATION. Sanders, S. M. Jr. (Du Ponte de Nemours (E. I.) and Co., Aiken, SC). Health Phys.; 27: No. 4, 359-365(Oct 1974).

Two incidents in which americium and curium aerosols were accidentally inhaled at the Savannah River Laboratory have provided some information on human metabolism of these elements. One occurred when a worker inhaled airborne particles containing relatively soluble ^{244}Cm. A total of 202 nCi was excreted in the feces during the first 7 days. Chest counting revealed only 14 nCi after 4.5 hr; the amount in the chest rapidly dropped to 5 nCi in 4 days. A chelating agent, trisodium diethylenetriaminepentaacetate (DTPA), did not significantly increase the excretion rate of the relatively fixed curium. A second incident involved the inhalation of oxides of both curium and americium at a radiation ratio of 75% ^{244}Cm and 25% ^{241}Am. Over 1200 nCi were taken into the body. After 2.5 hr, 456 nCi remained in the chest. During the first 7 days, 1172 nCi was excreted in the feces, and all but 37 nCi was removed from the chest. About 4 nCi of the oxide appears to have been rapidly dissolved, either by gastric juices or as a result of an initial treatment with DTPA, and excreted with two biological half-lives, i.e. 5.7 days for ^{244}Cm and 35 days for ^{241}Am. Data obtained from analyses of urine and feces were plotted and regression lines were fitted by the least-squares method. By integrating the regression equation between various time sequences, the biological half-lives of the residual radioisotopes were determined, permitting a temporal interpretation of the movement of the isotopes in the subjects. (auth)

6372 EXCHANGE KINETICS AND DOSIMETRY OF TRITIUM OXIDE IN MAN FOR DIFFERENT ROUTES OF ADMINISTRATION. Balanov, M. I.; Dolgirev, E. I.; Likhtarev, I. A. (Leningrad Inst. of Radiation Hygiene). Health Phys.; 27: No. 4, 367-375(Oct 1974).

The transport kinetics of body fluids in man was studied after an intravenous injection, inhalation, and ingestion of THO. The excretion of incorporated tritium was followed during 300 days. The mathematical compartment model of THO metabolism was suggested. The full set of model parameters was obtained. The specificity of irradiation of respiratory tract and body soft tissues was considered. (auth)

Animals

Refer also to abstracts 6383 and 6445.

6373 (ORNL-4979, pp 30-32) DOSIMETRIC DATA FOR COPPER. Bernard, S. R. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

A metabolic model for Cu uptake and distribution following ingestion by man was tested in rats using ^{64}Cu as tracer. (CH)

6374 TISSUE ISOTOPE CLEARANCE. III. Variability Attributed to Age, Sex, and Core Temperature in Rats. Gangarosa, L. P.; Hung, C. T.; Morse, P. K. (Medical Coll. of Georgia, Augusta). Proc. Soc. Exp. Biol. Med.; 147: No. 1, 239-241(Oct 1974).

Rats aged 45 days to 12 mo were assigned to 3 core temperature ranges, 93.5 to 95.5°, 100 to 102°, and 105 to 107°F. They were anesthetized with a mixture of pentobarbital and barbital. Subcutaneous injections of ^{131}I-4-iodoantipyrine (IAP) in saline were given, and control injections contained tetracaine or prilocaine. When the IAP injection was given in saline, significant independent effects were obtained for sex, body temperature, and the interaction between age and sex. Clearances obtained from an injection of an IAP solution containing prilocaine identified age and temperature as significant sources of variation. When the IAP solution was used with tetracaine the significant sources of variability were age, sex, and temperature as well as the age-sex interaction. (HLW)

6375 EXCRETION OF URANIUM FROM THE BODY AFTER RESPIRATORY AND INTRAVENOUS ADMINISTRATION OF AMMONIUM DIURANATE. Galibin, G. P. Gig. Sanit.; No. 8, 31-35 (Aug 1974). (In Russian).

Experiments performed on rats showed that after intravenous administration of ammonium diuranate excretion of uranium in urine and feces proceeded according to two exponents: T_{biol} of quickly excreted fractions of uranium in urine comprised 1.8 days and in the feces — 1.8 days and that of slowly excreted fractions comprised 16 and 7 days, respectively. After a single inhalation T_{biol} of quickly excreted fractions in urine comprised 2 days and in feces — 12 days, that of slowly excreted fractions comprise 16 and 12 days respectively. On the basis of experimental data obtained the author determines the ratio of the amount of uranium in the excreta to that in the body depending on the time of incorporation. (auth)

6376 RADIONUCLIDE PENETRATION THROUGH THE PLACENTA TO THE EMBRYO. Voevodina, T. M. (Leningrad Scientific-Research Inst. of Radiation Hygiene). Gig. Sanit.; No. 8, 109-111(Aug 1974). (In Russian).

The relations of radionuclide transfer across the placenta and (1) the fraction of the nuclide bound to the blood protein and (2) the energy of hydration of the nuclide are shown graphically and discussed. The volume of the nuclide and its complex-forming capability also have some effect on the transfer through the placenta. (MG)

6377 DISTRIBUTION OF ^{226}Ra IN THE BONES OF MICE. Kofranek, V.; Parizek, O.; Machek, J.; Thomas, J.; Hanzlik, J. Acta Radiol., Ther., Phys., Biol.; 12: No. 4, 353-367(1973).

The time course of ^{226}Ra distribution was investigated in separated parts of the femora and vertebrae of young female mice after single injections of 0.03 μCi/g body weight by radiochemistry and SST autoradiography. Quantitative autoradiography afforded more precise data than radiochemistry. The data were used for dose determinations, especially in the growth plates and in the trabecular and compact bones. (auth)

6378 COPROPHAGY IN LABORATORY ANIMALS: A PRELIMINARY STUDY TO ASSESS POTENTIAL INFLUENCES OF EXCRETA INGESTION ON RADIONUCLIDE RETENTION PATTERNS. Thomas, R. L.; Roe, L. J. (Inhalation Toxicology Research Inst., Albuquerque, NM). Amer. Ind. Hyg. Ass. J.; 35: No. 11, 741-747(Nov 1974).

Rats were gavaged with $^{144}CeCl_3$ and either prevented from or allowed to practice coprophagy. Whole-body retention data varied widely and, in some instances, resulted in highly erratic patterns and enhanced gastrointestinal tract absorption of gavaged ^{144}Ce in coprophagy-allowed rats. Greater whole-body retention of ^{141}Ce was observed in coprophagy-allowed animals kept in solid plastic shoe box-type cages than in those kept in wire-bottom cages, owing to their continued access to the radioactive feces excreted within the first days after ^{144}Ce gavage. Potential influences of coprophagy on results of experiments involving toxic materials are discussed. (auth)

6379 COMPARATIVE DISTRIBUTION AND EXCRETION OF ^{237}Pu AND ^{239}Pu NITRATES IN BEAGLE DOGS. Bair, W. J.; Willard, D. H.; Nelson, I. C.; Case, A. C. (Battelle Pacific Northwest Labs., Richland, WA). Health Phys.; 27: No. 4, 392-396(Oct 1974).

The purpose of the experiment described was to obtain preliminary comparative data on the metabolic behavior of intravenously injected $^{237}Pu(NO_3)_4$ and $^{239}Pu(NO_3)_4$ in the beagle dog to determine the usefulness of ^{237}Pu as a substitute for ^{239}Pu in studies of plutonium in experimental animals and possibly in human beings. The distribution and excretion of intravenously injected ^{237}Pu and ^{239}Pu are compared in tabular form. Graphs of the complete excretion data for one ^{237}Pu dog and one ^{239}Pu dog are given. ^{237}Pu was in a very low concentration which minimized colloid formation while the concentration of the injected ^{239}Pu was great enough to promote colloid formation at the neutral pH of the blood. An interesting observation was the continued enhanced level of excretion of ^{237}Pu for as long as 30 days following injection. Excretion of ^{237}Pu remained 20 to 50 times higher than ^{239}Pu. Thus, it would appear that there was an effect of mass, not only on initial tissue deposition, but a continuing effect on the dynamic state of the deposited plutonium. This study confirms that the mass of plutonium administered is an important experimental variable affecting plutonium distribution. The effect this has on the extrapolation of results of ^{237}Pu administration to that of ^{239}Pu is discussed. (UK)

Plants

Refer also to abstracts 8042 and 8055.

6380 NEW MOLECULES IN THE FUNCTIONAL HEPATIC EXPLORATION. Lapalus, F.; Moreau, M. F. (Faculte de Medecine et de Pharmacie, Clermont-Ferrand, France). pp 218-225 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A series of new ^{131}I-labelled indomonocarbocyanines were studied in rats with respect to their biliary elimination and possible use as liver scanning agents. The results obtained are compared with those obtained with presently used labelled dyes. (JSR)

6381 NUCLEI ACID METABOLISM IN RYE EMBRYOS AT SUBCELLULAR LEVEL. Golaszewski, T.; Rytel, M.; Szarkowski, J. W. (Polska Akademia Nauk, Warsaw. Instytut Biochemii i Biofizyki). Bull. Acad. Pol. Sci., Ser. Sci. Biol.; 20: 539-542 (1972).

Incorporation of 2-^{14}C-uracil in vitro and 6-^{3}H-thymidine in vivo into RNA and DNA, respectively, of subcellular fractions isolated by means of differential centrifugation technique from ungerminated embryos and 24-hour-old seedlings of rye (Secale cereale L.) was studied. RNA's bound with subcellular fractions of the 24-hour-old seedlings are labelled more intensively as compared with those bound with analogical fractions isolated from ungerminated embryos. In the in vivo experiments the preferential labelling of DNA bound with light (extranuclear) subcellular fractions of the 24-hour-old seedlings has been stated. Sequence of initiation of RNA and DNA metabolism during plant embryo germination is discussed. Suggestion is being made that the preferential labelling of DNA of light subcellular fractions observed reflects organellogenesis processes during the early stage of plant embryo germination. (auth)

6382 THE LEAF UPTAKE OF $^{14}CO_2$ AND TRANSLOCATION OF ^{14}C-ASSIMILATES IN BEAN PLANTS GROWN UNDER CONDITIONS OF P-, Ca- OR K-DEFICIENCY. Gej, B. (Szkola Glowna Gospodarstwa Wiejskiego, Warsaw (Poland). Instytut Biologii Roslin). Bull. Acad. Pol. Sci., Ser. Sci. Biol.; 20: 803-808(1972).

Experiments performed on young bean plants of "Berna" var. in water cultures showed that in the plants deprived of phosphorus the foliar introduction of even small quantities of this element caused an increase in the photosynthesis of the leaves. But the percentual share of the ^{14}C-assimilates translocated from leaves to the main shoot and roots was somewhat higher in the P-deficient plants than in the control ones. On the other hand, in the case of K-deficient conditions the transport of ^{14}C compounds markedly decreased. Ca-deficiency shares in the complete inhibition of transport of those among the photosynthesis products that accumulate in the leaf assimilation tissue, which has not been elucidated yet. At the same time it was stated that, both in the mineral deficiency conditions and in the control, no translocation of the assimilates from one to the opposite primary bean leaf occurred. (auth)

Microorganisms

Refer also to abstract 6364.

New Tracer Techniques

Refer also to abstracts 5551, 5552, 5594, 5692, 5711, 5712, 6025, 6380, and 6437.

6383 (IRI-133-74-03) EFFECT OF COMPLEXING AGENTS ON THE ACCUMULATION OF ZINC IN THE PANCREAS OF THE RAT. Stortenbeek, A. J.; van der Hamer, C. J. A. (Interuniversitair Reactor Instituut, Delft (Netherlands)). [nd]. 13p. (In Dutch). Dep. NTIS (US Sales Only) $4.00.

The effects of various complexing agents on the uptake and retention of ^{65}Zn in the pancreas were studied in rats. The agents investigated in vitro included Zn complexes with glycine, o-phenantroline, and EDTA. The tabulated results show that the glycine complex was instable, the EDTA complex was stable, and the phenantroline complex had an intermediate position. The agents tested in vivo included acetate, histidine, peptide mixtures, cysteine, and penicillamine. Two hours after injection of the ^{65}Zn and the complexing agent the rats were decapitated and the percentage of injected ^{65}Zn was determined for the pancreas, liver, kidneys, and brain. The significance of the results obtained in the understanding of the transport mechanism are discussed. (JSR)

6384 DEVELOPMENT OF RADIOISOTOPIC DIAGNOSTIC METHODS IN THE USSR. Zubovskii, G. A.; Spesivtseva, V. G. Sov. Med.; 35: 3-9(Nov 1972). (In Russian).

The development of radioisotopic diagnostic methods in the USSR is reviewed with mention of some of the persons and institutes responsible and of the chief radioisotopes used. (tr-auth)

6385 INVESTIGATIONS ON THE BLOOD VOLUME IN CHICKS USING RADIOACTIVE CHROMIUM. Rusov, C.; Movsesijan, M.; Zivkovic, R. (INEP, Zemun, Yugoslavia). Vet. Glas.; 27: No. 1, 31-35(1973). (In Slovak).

The determination of the total blood volume, plasma, and erythrocytes in normal Leghorn and White Rock breed, 5 month old chicks, and the ones with the stimulated and inhibited hematopoiesis was carried out with the erythrocytes labelled by radioactive chromium ($Na_2{}^{51}CrO_4$). Determination of blood volume in chicks by using radioactive chromium is easily performed and reliable. It could be employed in hematological and biochemical investigations. (Bull. Sci. Sect. A)

6386 EVALUATION OF NEWER TECHNIQUES FOR THE DIAGNOSIS OF VENOUS THROMBOSIS. Johnson, W. C. (Tufts Univ., Boston). J. Surg. Res.; 16: No. 5, 473-481(May 1974).

Thirty-two extremities in 30 patients with various venous disorders were comparatively studied by clinical examination, impedance phlebography, Doppler examination, and ^{99}Tc isotopic venography for the presence of venous thrombosis. The only technique in this study that was statistically significant was ^{99m}Tc isotopic venography. (auth)

6387 TESTICULAR BLOOD FLOW RATES IN PREPUBERTAL AND ADULT RABBITS MEASURED BY ^{85}Kr. Larson, L. L.; Foote, R. H. (Cornell Univ., Ithaca, NY). Proc. Soc. Exp. Biol. Med.; 147: No. 1, 151-153(Oct 1974).

LH and FSH given to 12-week old rabbits for 17 days failed to alter spermatogenesis or blood flow. As testes grew in gonadotropin treated males, or controls ranging in age from 12 weeks to 3 years, the increase in total blood flow corresponded to the increase in testis size. Overall, the mean testicular blood flow rate for 80 measurements was 0.120 ml/g tissue/min. (auth)

6388 THE LABELLING OF RED-CELLS WITH RADIOACTIVE INDIUM ISOTOPES. P. 1. Method of In-Vitro Studies. Sinn, H.; Georgi, P.; Clorius, J.; Maier-Borst, W. (Deutsches Krebsforschungszentrum, Heidelberg (F. R. Germany). Inst. fuer Nuklearmedizin). Nucl.-Med.; 13: No. 2, 180-185(Aug 1974). (In German).

3 tabs.; 14 refs.

A method of labelling red-cells with In isotopes is presented. The stability of the binding and the labelling efficiency is practically identical with that of Cr. The first experiments indicate that In similar to Cr, is bound to cell protein and not the cell membrane. The possibility to choose between the different radionuclides of In offers an almost optimal use, depending on the medical question. (auth)

6389 SOME EXPERIENCES WITH THE PREPARATION OF ^{99m}Tc-DTPA. Tertoolen, J. F. W. (Isotopenlaboratorium

Voorburg, Vught (Netherlands)). Nucl.-Med.; 13: No. 2, 170-179 (Aug 1974).

8 figs.; 7 refs.

The behaviour of ^{99m}Tc after preparation of Tc-DTPA is studied. Blood incubation tests suggest a good chemical stability of Tc-DTPA. Tc-proteins and a pertechnetate-like compound are formed by a radiochemical impurity during the vitro incubation of freshly prepared ^{99m}Tc-DTPA with blood. (auth)

6390 A STUDY OF CELLULAR INFLAMMATORY REACTION IN HUMAN MALIGNANT MELANOMA, USING IN VITRO-LABELLING TECHNIQUES WITH H3-THYMIDINE. Pullmann, H.; Steigleder, G. K. (Koeln Univ. (F.R. Germany). Hautklinik). Arch. Dermatol. Forsch.; 249: No. 3, 285-289(1974).

2 tabs.; 23 refs.

Cellular inflammatory reaction in 15 patients with malignant melanoma was investigated with the aid of a ^{3}H-thymidine labelling in vitro technique. Eleven of these patients had primary tumors (4 superficial spreading melanomas, 7 tumorous forms), and 4 had metastases. Two patients with progressive metastases were examined at the stage with metastases in the regional lymph nodes, and also after generalization. A great number of lymphoid cells synthesizing DNA in the infiltrate was found. Other cells were of little significance and their role in inflammatory cellular reaction seemed to be negligible. The cellular inflammatory reaction in malignant melanoma is an immunological phenomenon mediated by activated lymphocytes entering the infiltrate from the blood stream. There were significant differences between primary tumors and metastases, as regards the number of H-3-labelled infiltrate cells. With progressive metastases there was a decrease in the number of labelled cells in the infiltrate. Findings point to a progressive loss of immunological defence with the development of tumor disease. Thus labelling the lymphoid cells may be helpful in determining the prognosis of malignant melanoma. (auth)

6391 FIFTEENTH FRENCH SYMPOSIUM ON NUCLEAR MEDICINE, LOUVAIN, BELGIUM, JUNE 1-2, 1973. Beckers, C.; Piret, L. (eds.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). 513p. (In French and English). (CONF-730681.

Separate abstracts were prepared for 47 papers presented at this symposium on nuclear medicine. (CH)

For abstracts of individual papers see: 6025, 6380, and 6392-6436.

6392 DYNAMIC QUALITATIVE AND QUANTITATIVE EXPLORATIONS WITH THE GAMMA CAMERA. Piret, L.; Van Der Linden, S. (Cliniques Universitaires Saint-Pierre, Louvain, Belg.). pp 15-31 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

The different systems presently utilized in order to perform dynamic radionuclide diagnostic studies (qualitative and quantitative) with the scintillation γ camera were examined. The results of an enquiry on the data collected in 37 different departments of nuclear medicine performing such studies are discussed allowing conclusions as to the use of this type of examinations. The problems arising in the utilization of a γ camera and its accessories in dynamic quantitative studies are considered. (auth)

6393 NEW METHOD FOR THE PREPARATION OF LABELLED SUBSTANCES FOR DYNAMIC EXPLORATIONS. Benes, I. (Stadtspital Triemli, Zurich); de Schrijver, M. pp 32-41 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A new method for labelling with ^{99m}Tc, which facilitates both dynamic and static diagnostic studies is presented. The method is based on coprecipitation with iron hydroxide. The new technique offers numerous advantages from the practical and economic viewpoint and gives better results. The preparation of concentrated ^{99m}Tc is illustrated by an example. The method is used routinely in the Waid and Triemli hospitals at Zurich. Several hundred patients have been examined with the aid of this technique; numerous patients have received repeated administration of these preparations without secondary effects or incidents. It is highly recommended for all routine examinations. (tr-auth)

6394 DYNAMIC QUALITATIVE AND QUANTITATIVE EXPLORATIONS WITH THE GAMMA CAMERA. Applications in the Renal Region. Valeyre, J. (Institut J. Godinot, Reims); Raynaud, G.; Vinot, J. M. pp 42-55 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A stationary scintillation camera with a multichannel analyzer, and magnetic tape sequential recorder, and a computer can be used for both qualitative and quantitative dynamic radionuclide diagnostic studies. These uses are illustrated by three typical protocols in which ^{99m}Tc-pertechnetate, ^{131}I-hippuran, and ^{203}Hg-neohydrin and $^{197}Hg_2Cl_2$ are used for sequential exploration of the renal vascularization, sequential exploration of the renal function, and quantitative renal scintigraphy. (JSR)

6395 SEQUENTIAL AND REGIONAL RENAL QUANTITATIVE EXPLORATION. Delaloye, B.; Bischof-Delaloye, A. (Hopital Cantonal, Lausanne, Switzerland). pp 56-59 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

Experience is reviewed for kidney scanning on 200 patients with arterial hypertension with and without renal arterial stenosis, cancer of the colon, cysts, and urinary tract infections. It is recommended that ^{123}I-labeled compounds and a γ camera with background subtraction be used instead of ^{131}I-labeled compounds and other radioisotope scanners. Sequential images gave valuable information as to regional arterial stenosis and blood flow, modifications in renal clearance time, and regional pathology. (CH)

6396 SEQUENTIAL SCINTIGRAPHY IN THE MONITORING OF THE TRANSPLANTED KIDNEY. Guihard, R. (Centre Rene Gauducheau, Nantes, France); Guihard, D.; Chatal, J. F.; Guenal, J.; Fontenaille, C.; Quillard, M.; Buzelin, J. M. pp 60-73 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

Dynamic studies for the survey of transplanted kidneys were made with the γ camera, using two radioisotope compounds: ^{99m}Tc-pertechnetate for vascularization study and ^{131}I-hippuran for morphologic and functional (concentration-excretion) studies of the transplant. Use of sequential scintiphotos together with dynamic studies is shown to be very important, offering a better approach for differential diagnosis of various pathological pathways: rejection, acute tubular necrosis, arterial thrombosis, obstruction of urinary tract. (auth)

6397 CORRECTION METHOD FOR THE EVALUATION OF THE RENAL FIXATION RATE OF ^{197}Hg WITH THE GAMMA CAMERA. Melki, G.; Guelfi, J. (Laboratoire de Physique, Rennes, France). pp 74-79 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

The evaluation of the renal fixation rate for ^{197}Hg should be corrected for the hepatic fixation, a parameter neglected by most authors. A method is presented for this correction. (JSR)

6398 BLADDER-UTERO-RENAL REFLUX STUDIED BY THE ASSOCIATION OF THE SCINTILLATION CHAMBER AND CYSTOSPHINCTEROMANOMETRY. Timmermans, L. (Univ., Liege). pp 80-82 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

The use of a scintillation γ camera and ^{131}I-hippuran for the study of the bladder-ureter-renal reflux is described. The results obtained are compared with those obtained by other methods. For renal refluxes practically the same results are obtained, but the results obtained for refluxes of the other regions are not as precise. The use of the technique should be limited to those cases where prolonged radiological exploration is counter-indicated or where special conditions of reflux study exist. (JSR)

6399 DYNAMIC QUALITATIVE AND QUANTITATIVE EXPLORATIONS WITH THE GAMMA CAMERA. Application in the Cerebral Region. Itti, R. (Service des Isotopes, Tours, France); Ancri, D.; Plagne, R. pp 83-125 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

A review is presented of radionuclide qualitative and quantitative dynamic studies of the cerebral region with the γ camera using various compounds labeled with ^{99m}Tc, ^{113}In, ^{123}I, ^{131}I, or injected ^{133}Xe. A preliminary classification is given of diagnostic criteria. The difficulties and limitations of gamma angioencephalography are examined. Possible future developments in quantitative studies are indicated. (85 references) (JSR)

6400 PROGRAMMED EVALUATION OF THE CEREBRAL ANGIOSCINTIGRAPHS. Balikdjian, D.; Noterman, J.; Verbist, A.; Fruhling, J. (Universite Libre, Brussels). pp 126-128 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

The computer analysis of angiosctigraphic data on the brain is described. The data obtained on 35 cases showed that this combined technique permits an evaluation of a cerebral vascular deficit and has the advantage of being without danger and precise enough to be the technique of choice in this type of examination. (JSR)

6401 METHOD FOR THE AUTOMATIC CONSTRUCTION OF THE RING SCHEME IN PROFILED CEREBRAL CINEANGIOSCINTIGRAPHS. Bessou, M.; Bousquet, L.; Bru, A.; David, J.; Guiraud, R.; Pignolo, R.; Rascol, A.; Regis, H. (Universite Paul Sabatier, Toulouse). pp 129-133 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

An automatic method of Ring's diagram construction on cineangioscintigraphy is described. The data used for this construction are provided by standard x ray films. The aim of this method is to help interpret radionuclide cineangioscintigraphy studies of ischemic vascular diseases. (auth)

6402 FUNCTIONAL EXPLORATION OF THE LOCAL CEREBRAL OUTPUT WITH THE GAMMA CAMERA. Capon, A.; Fruhling, J.; Verbist, A.; de Rood, M. (Universite Libre, Brussels). pp 134-137 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

The technique used for functional exploration of local cerebral blood flow, based on the study of the elimination of ^{133}Xe after intracarotid injection and on the computer processing of data, is described. The results obtained on six patients with subacute or chronic cerebral vascular pathology are described. The results obtained in a further series of studies with modification of the technique to include administration of Fluothane are also reported. (JSR)

6403 CONTROL BY SEQUENTIAL SCINTIGRAPHY OF THE FUNCTIONING OF DERIVATION SYSTEMS USED IN THE TREATMENT OF HYDROCEPHALIA. Guihard, R. (Centre Rene Gaudducheau, Nantes, France); Guihard, D.; Chatal, J.; Lebastard-Sartre, R.; Resche, F.; Arnaud, P. pp 138-146 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

A technique based on following the dynamics of ^{99m}Tc in the efferent catheter and the delay of the appearance of the radioactivity in the thyroid with oscillographic control and sequential scintigraphs is reported for the study of the effects of therapy in hydrocephalus. The protocol is outlined and examples are given of the results obtained. The technique is without danger to the patient and requires neither preparation nor hospitalization. (JSR)

6404 DYNAMIC QUALITATIVE AND QUANTITATIVE EXPLORATIONS WITH THE GAMMA CAMERA. Application in the Pulmonary Region. De Roo, M.; Demedts, M. (Catholic Univ., Louvain, Belg.). pp 147-161 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

Use of the γ camera and ^{133}Xe and ^{15}O tracers in the study of pulmonary perfusion and ventilation and their regional ratio is discussed. The physiological bases of the dynamic examination of pulmonary function with radioactive gases are outlined. The technique for measurement of the pulmonary function is described in detail. It was concluded that this technique, in comparison with other techniques, more nearly approaches functional reality. (JSR)

6405 DYNAMIC VASCULAR AND VENTILATORY PULMONARY EXPLORATIONS DONE ROUTINELY USING A GAMMA CAMERA AND DATA PROCESSING. Munsch, R. C.; Briere, J.; Dahoun, A.; Berger, M. (Faculte Mixte de Medecine et de Pharmacie, Lyon). pp 162-178 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

Xenon-133 in the gaseous form was used for the pulmonary ventilation study using an inhalation system that permits, because of a maximum reduction of the dilution volume of the gas and of the dead space, an excellent specific activity in the exhaled air. The gas kinetics were studied during the respiratory cycle at the level of the lungs and also in the peripheral circulation. Technetium-99-labelled microspheres were then used to study the vascular phase of lung perfusion. The comparative study of the data from these two types of examination appear necessary for a good interpretation of the results and particularly for the early detection of pulmonary neoplasm and for the evaluation of the pathology of pulmonary embolism. (tr-auth)

6406 PULMONARY ARTERIOGRAMS USING A CAMERA WITH BRILLANCE AMPLIFIER. Gongora, R.; Perdereau, B.; Gongora, G.; Parrot, R.; Jammet, H. (Institut du Radium, Paris). pp 179-191 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

A method yielding simultaneously a cineangiocardiogram consisting of both a radiocardiogram and pulmonary arteriogram, pneumogram, and electrocardiogram is described and typical results are shown. A γ camera and ^{99m}Tc-pertechnetate and ^{99m}Tc-serum albumin administered by intravenous injection were used. The results obtained by an association of cineangiocardiogram and pneumogram are illustrated by several case studies. The pathology revealed by these techniques is also illustrated by case studies. (JSR)

6407 DYNAMIC AND QUANTITATIVE EXPLORATIONS WITH THE GAMMA CAMERA IN HEPATOLOGY. Desgrez, A. (Hopital d'Orsay, France). pp 192-295 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

Three types of radionuclide kinetic studies are possible in hepatology: blood purification of colloids, blood purification of dyes, and dynamic hepatic liquid studies. Each of these is described. The efficiency of a γ camera with a cinescintigraphic device for quantitative studies using ^{131}I, ^{125}I, ^{99m}Tc-serum albumin, and ^{99m}Tc-colloids as tracers is described. (JSR)

6408 USE OF A HEPATIC PERFUSION INDEX CONNECTED WITH THE CLEARANCE OF ^{99m}Tc LABELLED COLLOIDS. Possibilities Opened by the Study of Kupffer Sites With Respect to the Phagocyte Function. Behar, A.; Richalet, J. P.; Herszberg, B. (Paris Univ., Creteil, France). pp 206-215 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

An exponential model for calculation of the hepatic clearance is described when ^{99m}Tc-colloids are used for scintiscanning. The problems of the extra-hepatic fixation are integrated in the definition of this model. A formula for the hepatic fractional clearance and a hepatic perfusion index is proposed. A classification of the results on 100 patients showed the efficiency of the proposed index primarily in the separation of cirrhotic patients and normal subjects. The method also does not allow the distinction between phagocyte functions of Kupffer cells and perfusion ailments. A method is proposed for cases where the separation between circulation troubles and damage to uptake sites is necessary (for example in Hodgkin's disease). (tr-auth)

6409 ^{131}I-LABELLED BENGAL ROSE TEST IN LIVER BILE PATHOLOGY (ITS USE IN THE DIAGNOSIS OF RETENTION JAUNDICE). Lahneche, B.; Brette, R.; Bertrand, J. L.; Cruaud,

D.; Elizagaray, A. (Centre Leon Berard, Lyon). pp 216-217 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

The results obtained on more than 100 patients with jaundice using the classic technique of ^{131}I- labelled rose bengal and a γ camera as detector coupled with a storage visualization unit and a data processing unit are reported. The advantages of a scintillation camera and a screen for the instantaneous visualization of the scintigraphic image are emphasized. (JSR)

6410 UMBILICO-PORTAL VEIN SCINTIGRAPHY. Moretti, J. L.; Gross, G. (Hopital Henri-Mondor, Creteil, France). pp 226-237 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

A method is proposed for the visualization of the hepatic parenchyma and for measurement of the portacaval blood flow in patients with portal hypertension. The technique uses scintiscanning following injection of ^{99m}Tc-albumin microspheres into the umbilical vein. (CH)

6411 ISOTOPIC SPLENOPORTOGRAPHY: MORPHOLOGICAL AND HEMODYNAMIC RESULTS. Vinot, J. M. (Hopital Cochin, Paris); Syrota, A.; Paraf, A.; Roucayrol, J. C. pp 238-247 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681.

The intraspleen injection of ^{99m}Tc-albumin makes it possible to obtain γ camera images of the vascularization of the portal system. The hepatic and cardiac activity curves show very clearly the existence of portacaval passages. They show primarily the diagnostic value of studies of the total hepatic blood flow in patients without shunt, and in association with the clearance of indocyanine green they measure the rate of passing in the collateral circulation when porto-systemic anastomosis exists. (tr-auth)

6412 TOMOGRAPHY AND THE PHO-GAMMA SCINTILLATION CHAMBER: ITS PHYSICAL PRINCIPLES AND ITS OPERATION. Van Oortmarssen, G.; Kulberg, G. H. (G. D. Searle Nederland b.v, Uithoorn, Holland). pp 248-260 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

The operational principles of the tomographic system using a γ camera and ^{99m}Tc with collimator rotation are explained. This system makes possible the discrimination and visualization of sections at different levels of an organ as a function of the distance between these levels and the surface of the collimator. (tr-auth)

6413 TOMO-CAMERA IN CURRENT HOSPITAL PRACTICE. Ducassou, D.; Leccia, F.; Basse-Cathalinat, B.; Blanquet, P. (Hospital Saint-Andre, Bordeaux). pp 261-272 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

Experience in tomographic studies of different organs: liver, spleen, brain, and bone using ^{99m}Tc-labeled compounds and a γ camera is reported. More than 150 scintigraphy-scintitomography comparisons were made for these organs. In the study of the liver and the spleen, examining cross-sections of the organ allows a better analysis of the morphologic variations which on the standard images translate themselves as suspicious areas of decreased activity, and allows a better localization of the lesion and better appreciation of its size. This fact is particularly clear in the study of the skeleton. Even though it is only used in exceptional cases, it always allows the problem posed to be resolved. (CH)

6414 TOMOSCINTIGRAPHY BY GAMMA CAMERA. Lahneche, B.; Elizagaray, A.; Gerson, A.; Fleury-Goyon, M. C. (Centre Leon Berard, Lyon). pp 273-274 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A tomographic system is described consisting of an Anger-type γ camera provided with a special collimator with parallel holes inclined to 20° on the axis of the collimator and a mobile examination table. The collimator can be rotated around its axis and this, in conjunction with the mobile examination table, permits a tomographic effect to be obtained. Only tracers emitting γ radiation (primarily ^{99m}Tc) can be used. The advantages of this system during scintigraphic examinations of the brain, skeleton, liver, and spleen are discussed. Improvements can be made to the installation that would permit the use of isotopes with high energies, the increase of the dimensions of the field explored, and the increase of the detection power. (JSR)

6415 ANALYSIS OF THE METHODS OF UTILIZATION OF THE DATA GATHERED BY THE SCINTILLATION CAMERA. Ter-Pogossian, M. M. (Washington Univ., St. Louis). pp 275-286 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

In its simpler form the Anger γ camera displays the data gathered as an image on the screen of a cathode ray tube. This image, which results from the spatial variation of density of points, is usually recorded photographically, either on Polaroid or on conventional emulsion. Thus the information is presented to the physician in a form similar to that of a conventional radiograph, and the physician generally establishes his diagnosis by the visual observation of the image on film (or on a series of films, particularly when dynamic studies are required) and usually no attempt is made to carry out further data processing. However, many γ cameras are now equipped with complex data storage, processing, and display equipment, which after complex processing, can display the data in a large number of various forms, such as color pictures, pseudo three-dimensional representations, isocount curves, and others. Procedures used for analogue and digital processing of scan data and the value of computer calculations in diagnostic studies are discussed. (CH)

6416 PRINCIPLES AND RECENT PROGRESS IN RADIOIMMUNOLOGY. Franchimont, P.; Hendrick, J. C. (Univ., Liege). pp 297-304 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A bibliographic review and evaluation is presented of studies on the principles and recent progress in radioimmunoassay. Isotopic labeling of antigen, preparation of antibodies, satisfactory separation of the free labeled antigen and of the labeled antigen fixed on antibodies, and radioimmunological determination using labeled antibodies are discussed. (50 references). (JSR)

6417 HUMAN CALCITONIN: RADIOIMMUNOLOGICAL DETERMINATION AND PHYSIOPATHOLOGICAL APPLICATIONS. Heynen, G.; Franchimont, P. (Univ., Liege). pp 305-320 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A method for the radioimmunological determination of human calcitonin was developed which permits the analysis in detail of each of the stages. This determination is very sensitive since it permits the detection of quantities of 10 pg/ml of serum by using a reference curve established in the presence of human serum proteins. The specificity of this system is made on the basis of immunological and biological criteria. The method is sufficiently sensitive to approach the study of the secretion mechanisms of human calcitonin in the normal person and in some pathological conditions. (tr-auth)

6418 RADIOIMMUNOLOGICAL DETERMINATION OF IMMUNOGLOBULINS E. First Results in an Infant. Dessaint, J. P.; Wattre, P.; Capron, A. pp 321-323 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

Preliminary results are presented of the radioimmunological determination of the immunoglobin IgE in infants and children from 6 weeks of age to 16 years. The results showed two important points: the need of having available a first evaluation of reference values as a function of age for the interpretation of results obtained in infantile allergology; and the existence of a relatively high rate of IgE in the first six weeks of life. (JSR)

6419 RADIOIMMUNOLOGICAL DETERMINATION OF THE AUSTRALIA ANTIBODY BY A SOLID-PHASE METHOD USING LABELLED ANTIBODIES. Leonard, J. P.; Doyen, G.; Beckers, C. (Cliniques Universitaires Saint-Pierre, Louvain, Belg.). pp 324-330 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A solid-phase method for the radioimmunoassay of anti-Australia antibodies, derived from the procedures of Catt and Salmon was developed. The results were compared to the classical counter-electrophoresis technique. The method consists of several successive incubation in plastic tubes which results in surfaces coated with a thin film of anti-Australia antibodies which can be stored at 4°C. On the day of determination the surfaces are rinsed in succession with a serum rich in Australian antigen, the unknown serum, and a solution of specific antibodies labelled with ^{125}I. The results obtained are shown graphically and in tabular form and indicated that the method is simple and rapid without the necessity of purification and labelling of Australian antigen. It is 100 times more sensitive than the counter-electrophoresis method. (JSR)

6420 RADIOIMMUNOLOGICAL DETERMINATION OF CARDIOTONICS AND ITS INTERPRETATION. Lesne, M. (Univ., Louvain, Belg.). pp 331-338 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

The radioimmunoassay of digitalis in clinical practice is reviewed. The most important factors in the technique of dosage and the difficulties in the interpretation of the results are analyzed. In conclusion, it appears that more selective and specific antibodies are needed for the various cardiac glycosides and that a better quantitative knowledge of the factors that modify the effect of digitalis in man could facilitate the clinical interpretation of the dosage and the establishment of the next posology for each patient. (auth)

6421 RADIOIMMUNOLOGICAL DETERMINATION OF GASTRIN. Meriadec, B.; Hegesippe, M. (CEN de Saclay, Gif-sur-Yvette, France). pp 339-344 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A method for the radioimmunoassay of gastrin is described. The determination of gastrin was developed by using synthetic gastrin. As the normal serum rate is of the order of 30 to 50 pg/ml, in order to have good sensitivity the tracer must have a specific activity of the order of 1,000 μc/mg. The conditions under which this activity can be obtained in the labelling are outlined. Purification after labelling is done by electrophoresis on polyacrylamide gel. The reactivity of gastrin-1-17 (the synthetic) and 2-17 was measured. The detection limits vary from 10 to 2 pg/ml according to the activity, antibody dilution, and the counting time. (JSR)

6422 DETECTION OF THE AUSTRALIA H. B. ANTIGEN AND ANTIBODIES BY THE RADIOIMMUNOLOGICAL TECHNIQUE IN SOLID PHASE. Moretti, J. L.; Wirquin, E.; Leguyec, S.; Etievant, M. F. (C. H. U. Henri Mondor, Creteil, France). pp 345-350 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A method is described for the radioimmunoassay of the Australian virus antibody. The solid-phase technique for the detection of the Australian virus antigen is described. Three methods were examined for the adaptation of this solid-phase technique to the determination of the anti-Australian virus antibody: a competitive method, a method by inhibition of a known antigen, and method by utilization of a known antigen previously fixed on the antibodies of the tube. Only this last method appeared reliable and very sensitive. The comparative results on the study of the Australia antigen by the radioimmunological method and by the electroimmunodiffusion technique showed that the radioimmunological technique had better sensitivity. The radioimmunological technique developed for the study of Australian virus antibodies was much more sensitive than the electroimmunodiffusion technique. (JSR)

6423 DETECTION OF THE AUSTRALIA ANTIGEN BY RADIOIMMUNOLOGICAL ASSAY IN SOLID PHASE. Collignon, G.; Mesnier, F.; Moulinier, J.; Blanquet, P. (Centre de Transfusion Sanguine, Bordeaux). pp 351-354 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A method is described for the radioimmunoassay of the Australian virus antigen. A solid-phase radioimmunological technique was used for the detection of the antigen and the results obtained on more than 3000 subjects were compared with those obtained by the immunodiffusion and immunoelectrodiffusion techniques. Because of its accuracy and high sensitivity this solid-phase technique appears superior. (JSR)

6424 RADIOIMMUNOLOGICAL DETERMINATION OF PLASMA ALDOSTERONE AND TESTOSTERONE USING ANTIBODIES FIXED ON CELLULOSE. Riviere, J. F.; Franchimont, P.; Bizollon, C. A.; Mallein, R.; Claustrat, B. (Hopitaux de Lyon). pp 355-365 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A radioimmunoassay technique for the determination of aldosterone and plasma testosterone was developed using the method of coupling the antibodies to an immunocellulose. The preparation of the immunoadsorbents and the determination of plasma aldosterone and testosterone after extraction and purification are described. The determination is based on tracing the B/T curve as a function of the mass of the steroid, where B is the activity of the antigen-antibody complex and T is the total activity present in the reaction medium. The specificity of the anto-aldosterone and anti-testosterone antibodies coupled on cellulose are tabulated and the interference rate is calculated. The results obtained are completely satisfactory. (JSR)

6425 PRACTICAL APPLICATION OF THE RADIOIMMUNOLOGICAL DETERMINATION OF THE ANGIOTENSINS I AND II. Vallotton, M. B. (Faculty of Medicine, Geneva). pp 366-372 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

The radioimmunological determinations of the angiotensins I and II have the advantages of specificity, sensitivity, precision, reproducibility, and simplicity. The results of the routine use of this technique were discussed from the viewpoint of the collection of the plasma sample, incubation of the plasma for the activity of the renin, radioimmunological determination, and preparation of the tubes and mixture of reagents. (JSR)

6426 EXPERIENCES IN THE AUTOMATION OF RADIOIMMUNOLOGICAL DETERMINATIONS. Ingrand, J.; Linhart, N.; Roucayrol, J. C. (Hopital Cochin, Paris). pp 373-393 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

Experience with the automation of radioimmunoassay methods are reported. A detailed description is made of an automatic device and the results obtained with it in the routine determination of insulin. A critical analysis is made of the performance of the device with respect to the mode of addition of the talc, reproducibility, and inter-sample pollution. The results obtained in the measurement of insulin in blood serum from patients with insulin insufficiency are reported. The device can process 180 samples an hour. (JSR)

6427 STATISTICAL PROCESSING OF RESULTS OBTAINED DURING RADIOIMMUNOLOGICAL DETERMINATIONS. Burger, H. (Prince Henry's Hospital, Melbourne). pp 394-397 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A method is described for the computer processing of data from radioimmunoassay determinations. The method is based on the introduction of counting data into a computer program that gives, from the points obtained by the establishment of the standard curve, a curve following a mathematical function. From this the computer calculates the concentration of the antigens in the biological medium being examined. The program also defines the error of the standard curve, the sensitivity and precision of the determination, and the standard deviation of the results for each sample measured. The steps in the selection of an adequate mathematical model for this program are outlined. (JSR)

6428 IMPROVEMENT OF THE RIGOR OF THE RADIOIMMUNOLOGICAL CALCULATIONS BY MINIMIZATION OF THE VARIATIONS FROM THE REACTIONAL MODELS. Dreyer, J. P. (Centre Hospitalier Louis Pasteur, Colmar, France). pp 398–401 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A method is proposed which aims at minimizing the systematic deviations of the standard curve of radioimmunoassays. This method makes use of the standardization points and the knowledge of the chemical kinetics of the reaction. The mathematical equation of the reaction is solved by an optimization of the parameters with a computer. The knowledge of these values is of a great interest for the radioimmunologist. Such a program can be particularly applicable to some automated radioimmunoassays systems. (auth)

6429 STEROID RADIOIMMUNOASSAY. Rosa, U. (National Research Council, Pisa, Italy). pp 403–427 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

The main problems in steroid radioimmunoassay stems from two major considerations: the requirement of high levels of specificity in order to discriminate among closely related structures; and the peculiar features of steroid antisera. Both aspects are critically viewed in the light of the criteria to be adopted for preparation and selection of antisera and for the assay design. (auth)

6430 PRESENT STATUS OF THE SCINTIGRAPHY OF THE BONE MARROW. Rain, J. D.; Dresch, C.; Robigo, A.; Najean, Y. (Hopital Saint-Louis, Paris). pp 431–442 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

The advantages and disadvantages of the principal isotopes presently used for scintigraphs of the bone marrow (^{198}Au, ^{99m}Tc, ^{113m}In, ^{52}Fe, and ^{59}Fe) are discussed. From the experience gained on 55 cases using scintigraphy of the bone marrow it was concluded that there is a quasi constant parallelism between the uptake and the fixation of the two tracers, ^{59}Fe and ^{99m}Tc. The rate of fixation of colloids in the reticular marrow can not be considered as an index of the bone marrow cell number. The present interest in medullary scintigraphy appears to be related to the distribution of hemopoietic activity in the bone marrow. Unresolved problems connected with bone marrow scintigraphy and its future development are discussed. (JSR)

6431 IN VITRO EVIDENCE OF ANTI-PLATELET ANTIBODIES BY A RADIOISOTOPIC METHOD. Dechavanne, M. (Hopital E. Herriot, Lyon); Lagarde, M.; Pinelli, J. P.; Arnaud, P.; Viala, J. J. pp 443–451 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

Measurement of the percentage of serotonin excreted by patients was made using washed and previously ^{14}C-labelled normal human blood platelets. Results showed in the serum of patients with idiopathic thrombocytopenia purpura a factor provoking the excretion of serotonin. The test was consistently positive for idiopathic thrombopenic purpura patients (27 cases) and always negative in central thrombopenia (5 cases), as well as during various hematological illnesses with normal platelet count (11 cases). Test results were debatable in polytransfused patients having acquired platelet allo-antibodies and in patients having antinuclear antibodies. (tr-auth)

6432 DETERMINATION OF PLASMA 25 HYDROXYCHOLECALCIFEROL BY COMPETITION. Baret, A.; Mathieu, B.; Desbene, P. L.; Ceyte, P. J.; Morcellet, J. L. (Centre d'Etudes et de Recherches Biophysiologiques, Toulon, France). pp 452–461 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on Nuclear Medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A method for the determination of plasma 25 hydroxycholecalciferol by using normal human plasma treated with dextran carbon and diluted to $^{1}/_{1000}$ as a source of specific supporting proteins was developed. The different stages of the determination are included. (tr-auth)

6433 SIMPLIFIED MEASUREMENT OF THE FRACTIONAL DIGESTIVE ABSORPTION OF Ca BY INJECTION FOLLOWED BY INGESTION OF ^{47}Ca. Chanard, J.; Assailly, J.; Bader, C.; Funck-Brentano, J. L. (Hopital Necker, Paris). pp 462–474 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

A new method is described for the measurement of the fractional intestinal absorption of calcium which uses ingested ^{47}Co as a tracer and which permits the results to be obtained in 6 hrs. The method is based on the parallelism of the plasma radioactivity curves recorded in logarithmic coordinates, obtained after Ca venous injection and administration by mouth. The calculation is made by analysis of the plasma curves obtained from the two methods of injection of the same isotope. The validity of the method is discussed. The results obtained on patients with different categories of calcium metabolic difficulties, principally in renal insufficiencies treated and untreated by hemodialysis. (tr-auth)

6434 COMPARATIVE MEASUREMENT OF BLOOD FLOWS WITH ^{133}Xe AND ^{99m}Tc IN CERVICAL NEOPLASTIC ADENOPATHY. Cheguillaume, J.; Minier, J.; Chicos, G.; Geslin, J. (Centre Paul Papin, Angers, France). pp 475–480 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

The possibility of measuring the index of blood flow with ^{99m}Tc-pertechnetate in place of ^{133}Xe was investigated by comparing in 130 cases the values of the disappearance half-life of the two isotopes injected simultaneously. Measurement of the disappearance half-life of ^{99m}Tc-pertechnetate was also used to evaluate the radiosensitivity of cervical neoplasms of the uterus in 45 patients. The results showed that with certain precautions (lead mask) ^{99m}Tc-pertechnetate can replace ^{133}Xe in the measurement of the circulatory index. The indices calculated with ^{133}Xe and ^{99m}Tc-pertechnetate was almost identical in the 130 cases studied. The clinical study on 45 patients with neoplasms of the uterus confirmed that the $T_{\frac{1}{2}}$ circulatory index is a good test of radiosensitivity. (JSR)

6435 COMPARISON OF BONE SCINTIGRAPHY AND CONVENTIONAL METHODS FOR THE DETERMINATION OF THE ANATOMICAL DIMENSIONS OF TUMORS. Study on Osteosarcoma. Hoefer, R.; Kolarz, G.; Salzer, M.; Salzer-Kuntschik, M.; Willvonseder, R. (Univ., Vienna). pp 481–486 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973). (In French).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

The precision of the data obtained by bone scintigraphy using ^{87m}Sr with respect to the anatomical measurements of tumors was studied and compared with the precision obtained by other methods. The results indicate that the known precision of plantigraphy and angiography for delimitation of the extension of the extra-bone part of a tumor is augmented by the superiority of bone scintigraphy for the delineation of the intra-bone part of a tumor. (JSR)

6436 SIMULATION PROCEDURES IN NUCLEAR MEDICINE. Cantraine, F. R. L. (Faculty of Medicine, Brussels); Dewandre, B. pp 487–495 of Fifteenth French Symposium on Nuclear Medicine. Beckers, C. (ed.). Louvain, Belgium; Cliniques Universitaires Saint-Pierre (1973).

From 15th French symposium on nuclear medicine; Louvain, Belgium (1 Jun 1973). See CONF-730681-.

The use of radioactive tracers in medicine made it possible to measure characteristic parameters of the function of many organs, e.g. clearance, pool size, and secretion rate, The injection of small amounts of radioactive compounds traces their metabolism without disturbing the existing metabolic state and allows rather precise measurements with the aid of scintillation counters. Investigation of the metabolism of a given substance requires the study of one or several organs and their relationship with the whole organism. It is easy to investigate elementary parameters, but more difficult to assess their connections especially when there are several nonlinear steps. All data collected about a given metabolism have to be summarized and integrated into a mathematical model. The models are of great interest in basic physi-

ology to verify, after computing the solution of the equations, the assumptions made on the function of an organ. The models are also valuable in diagnosis, establishing normal ranges of the parameters. A quantitative and objective diagnosis will arise from the integrated parameters of a given patient, through the model. Abnormally low or high values will measure the degree of sickness of a patient. Four different aspects of the mathematical modeling theory encountered during the elaboration of a model of iodine metabolism in the thyroid are discussed in detail. (CH)

6437 MEDICAL APPLICATIONS OF RADIOISOTOPES. Grigg, E. R. N. (Cook City Hospital, Chicago). Trans. Amer. Nucl. Soc.; 19: 54(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6438 ^{123}Cs MYOCARDIAL SCINTIGRAPHY. August, L. S. (Naval Research Lab., Washington, DC).; Miller, G. E.; Adolph, R. J.; Romhilt, D. W.; Sodd, V. J. Trans. Amer. Nucl. Soc.; 19: 57(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6439 DEVELOPMENT OF ^{85m}Kr AS AN AGENT FOR LUNG SCANNING. Prasad, K. N. (Pennsylvania State Univ., University Park); Jester, W. A.; Jackson, G. L. Trans. Amer. Nucl. Soc.; 19: 57-58(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6440 MODALITIES IN DIAGNOSIS OF EARLY CANCER: TODAY AND TOMORROW. Pomerance, W. (National Institutes of Health, Bethesda, MD). Trans. Amer. Nucl. Soc.; 19: 61-62 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6441 EASY RADIOIMMUNOLOGICAL MICROASSAY OF RENIN ACTIVITY, CONCENTRATION, AND SUBSTRATE IN HUMAN AND ANIMAL PLASMA AND TISSUES BASED ON ANGIOTENSIN I TRAPPING BY ANTIBODY. Poulsen, K.; Jorgensen, J. (Univ. Institute for Experimental Medicine, Copenhagen). J. Clin. Endocrinol. Metab.; 39: No. 5, 816-825(Nov 1974).

The principle of antibody-trapping of angiotensin has allowed for the design of an analysis performed entirely within ope tube in a simple two-step procedure. The first step is addition of angiotensin I antiserum to the plasma. During incubation at 37°C at a controlled pH of 7.4, angiotensin I formed is captured and trapped by its antibody, giving protection against enzymatic conversion and degradation. In order to quantitate the angiotensin I formed the second step is addition of a large volume of ^{125}I-labeled angiotensin 1 at 0°C. The cooling and dilution virtually stop enzymatic reactions and angiotensin dissociates and competes with labeled angiotensin for the antibody as in other radioimmunoassays. The expected versatility is demonstrated by giving a detailed account on the measurement of renin concentration and activity in human and rat plasma as well as methods for determination of plasma renin substrate and tissue renin. Minute amounts of plasma are required. Five μl of rat plasma suffice for a single determination of renin or renin substrate concentrations and 75 μl of human plasma for a renin activity assay determined with a standard deviation of less than 10%. One technician performs easily 70 such assays per day. Finally, methods for correct adjustment of the antibody concentration to ensure complete capture of all angiotensin I formed are described. (auth)

6442 PLASMA 17-OH-PREGNENOLONE IN NORMAL SUBJECTS. McKenna, T. J.; DiPietro, D. L.; Brown, R. D.; Strott, C. A.; Liddle, G. W. (Vanderbilt Univ., Nashville). J. Clin. Endocrinol. Metab.; 39: No. 5, 833-841(Nov 1974).

A radioimmunoassay for 17-OH-pregnenolone was developed and applied to the study of this steroid in human plasma. Steroids that cross-react with the antiserum could be readily separated from 17-OH-pregnenolone; therefore the assay was highly specific. In normal subjects, plasma 17-OH-pregnenolone is mainly of adrenal origin. It was largely suppressible with dexamethasone, readily responsive to ACTH, and followed a diurnal rhythm similar to that of plasma fluorogenic corticosteroids with which there was a significant correlation ($p < 0.001$). Testicular secretion of 17-OH-pregnenolone could be inferred from the observation that while dexamethasone suppressed plasma concentrations incompletely combined treatments with dexamethasone and methyltestosterone caused the steroid to disappear completely. In contrast, women receiving dexamethasone alone had similar levels of 17-OH-pregnenolone to women receiving dexamethasone plus estrogen. Ovarian secretion of 17-OH-pregnenolone was suggested by the finding of significantly ($p < 0.05$) lower levels of plasma 17-OH-pregnenolone in women receiving estrogen than in untreated women. This difference was not seen in postmenopausal women. Treatment of premenopausal women with human chorionic gonadotropin resulted in small increases in plasma 17-OH-pregnenolone. Furthermore plasma 17-OH-pregnenolone was significantly ($p < 0.001$) higher during the follicular than during the luteal phase of the menstrual cycle. However, the ovarian contribution of 17-OH-pregnenolone to plasma (0.2 ng/ml or less) was probably inadequate to account for the phasic variation observed. The mechanism underlying the changes in plasma levels of 17-OH-pregnenolone seen during the menstrual cycle is unclear. (auth)

6443 VALIDITY OF COMPARING THE MEASUREMENTS OF ANGIOTENSIN I GENERATED IN HUMAN PLASMA BY RADIOIMMUNOASSAY AND BIOASSAY. Eggena, P.; Barrett, J. D.; Sambhi, M. P.; Wiedeman, C. E. (Veterans Administration Hospital, Los Angeles). J. Clin. Endocrinol. Metab.; 39: No. 5, 865-870(Nov 1974).

Differing results for the correlation between bioassay (BA) and radioimmunoassay (RIA) for angiotensin I (ang I) have been reported. To avoid many of the inconsistencies due to different methodology in sample preparation for RIA and BA and to study a wide range of ang I concentrations, plasma samples from hypertensive and normal subjects were incubated with varying concentrations of added exogenous renin by the method of Boucher and assayed by both RIA and BA. A least square regression analysis of all data indicates a BA to RIA ratio of 0.704 ± 0.75 and a correlation coefficient $r = 0.93$ ($p < 0.001$). Analyzing the data on individual subjects indicates subject specific BA to RIA ratios ranging from 1.34 ± 0.45 to 0.34 ± 0.08. Application of a common conversion factor for comparison of the two methods is therefore invalid when plasma samples from individual subjects are under investigation. Differential angiotensinase activity and/or interference by endogenous immunoreactive plasma factors in individual subjects did not account for the observed ratios. Generation of nonangiotensin cross-reacting substances was also excluded. (auth)

6444 RADIORECEPTOR ASSAY FOR SOMATOMEDIN A. Hall, K.; Takano, K.; Fryklund, L. (Karolinska Hospital, Stockholm). J. Clin. Endocrinol. Metab.; 39: No. 5, 973-976(Nov 1974).

Somatomedin A, which stimulates the incorporation of sulfate into chicken cartilage, has been purified from human plasma. The purified somatomedin A showed specific binding to human placenta membranes and a radioreceptor assay was developed for somatomedin A. Using this assay the mean level of somatomedin A in acromegalic sera is six times higher than in sera from patients with growth hormone deficiency. (auth)

6445 DISTRIBUTION OF RADIOACTIVITY AFTER ADMINISTRATION OF ^{125}I-LABELLED LUTEINIZING RELEASING HORMONE IN RATS. Isidori, A.; Spera, G.; Costa, T.; D'Alessio, A.; Fraioli, F. (Univ., Rome). Experientia; 30: No. 10, 1211-1213(15 Oct 1974).

The distribution of radioactivity in various organs following the administration of labelled luteinizing releasing hormone (LH-RH) in rats was studied. In male rats the radioactivity is selectively taken up by the pituitary. The kidney also shows a selective uptake. In female rats, radioactivity seems to be primarily concentrated in the hypophysis. Kidney and liver uptake values are also more pronounced than in male animals. In estrogen-treated females, pituitary uptake is markedly higher than in the other groups. (ERB)

6446 STUDY OF RELEASE AND UPTAKE OF MONOAMINES BY THE CENTRAL NERVOUS SYSTEM USING RADIONUCLIDES. Colombetti, L. G.; Glisson, S. (Veterans Hospital, Hines, IL). Radiobiol.-Radiother.; 15: No. 3, 425-433(1974).

The availability and use of high specific activity radionuclides such as ^{14}C and tritium has opened another dimension in the study of brain function. Previous studies have identified several of the processes which take place within the nerve terminals. These processes include neurotransmitter synthesis, storage, release, and inactivation. Although each of these processes is separate, they are interrelated through complex feedback systems. Until recently, the effects of drugs upon these processes has been mostly speculation. Now, utilizing the radiotracer techniques outlined above, we can obtain turnover measurements which will provide direct evidence of the effects of drugs on these neurotransmitter processes. And from such studies will come a better understanding of brain function. (auth)

6447 INDICATIONS TO APPLICATION OF RADIODIAGNOSTIC PROCEDURES IN CLINICAL ONCOLOGY. Agranat, V. Z.; Danichev, D. R.; Starinskii, V. V. (Moscow Scientific-Research

Inst. of Oncology). Vop. Onkol.; 20: No. 10, 3-7(1974). (In Russian).

The data reported present the authors' experience on using methods of radioisotope diagnosis in patients admitted in the institute for investigation and in those treated stationary. Indications were elaborated taking into account the opportunities of radioindication technique in solution of certain clinical problems, an up-to-date efficacy of radiodiagnostic apparatus, and characteristics of radioactive indicators employed. (auth)

6448 OPPORTUNITIES OF DIGITAL SCANNING IN DIAGNOSIS OF RENAL TUMORS AND CYSTS. Karetkina, E. I.; Tovstykh, A. M.; Klyucharev, B. V. (Research Inst. of Oncology, Leningrad). Vop. Onkol.; 20: No. 10, 24-29(1974). (In Russian).

The authors have discussed some opportunities of digital scanning on the machine "Scinticard-Numerik" (Gamma firm, Hungary) for diagnosis of renal tumors and cysts. To analyze scannograms manual methods of quantitative processing were employed: linear averaging of digits and determination of the correlation of the drug accumulation in kidneys. Three variants of scannograms observed in renal neoplasms are differentiated. The results obtained while applying the suggested methods are estimated, and the rationality of their clinical use is emphasized. (auth)

6449 RADIOIMMUNOASSAY OF VASOPRESSIN. A Note on Pituitary Vasopressin Content in Brattleboro Rats. van Wimersma Greidanus, T. B. (Univ. of Utrecht); Buys, R. M.; Hollemans, H. J. G.; de Jong, W. Experientia; 30: No. 10, 1217-1218(15 Oct 1974).

The radioimmunoassay of arginine-8-vasopressin described represents a sensitive method for the quantitative measurement of biologically active vasopressin. (ERB)

6450 CEREBRAL GAMMA-CAMERA GAMMAGRAPHY WITH ^{99m}Tc PERTECHNETATE ION. Coutinho, A. C. (Hospital Julio de Matos, Lisboa. Centro de Neurocirurgia); Godinho, F.; Baptista, A. M. (Laboratorio de Isotopos do Instituto Portugues de Oncologia de Francisco Gentil, Lisboa. Centro de Estudos de Medicina Nuclear). Arq. Patol. (Lisbon); 44: No. 2, 157-167 (1972).

From first national meeting on nuclear medicine; Lisbon, Portugal (Jun 1971).

Mechanisms of fixation of radionuclides in cerebral lesions are summarized and value of the detection of gamma radiation of Tc-99m by means of the gamma-camera is emphasized for the precise location and volume evaluation of cerebral neoplasms, when used in association with other neurosurgical diagnostic methods. Owing to its innocuity, quickness, accuracy, and to the lack of discomfort to the patient, the method is said to be particularly fit to be used on out-patients. (INIS)

6451 RADIONUCLIDE DETECTION OF DIFFUSE INTERSTITIAL PULMONARY CALCIFICATION. Grames, G. M.; Sauser, D. D.; Jansen, C.; Soderblom, R. E.; Hodgkin, J. E.; Stilson, M. S. (Loma Linda Univ., CA). J. Amer. Med. Ass.; 230: No. 7, 992-995(18 Nov 1974).

Two patients who had hypercalcemia, one from multiple myeloma and the other from metastatic carcinoma, showed striking concentrations of ^{99m}Tc-pyrophosphate in the lungs on routine bone scans. Neither patient had roentgenographic evidence of intrapulmonary calcification. Histologic examination in one patient showed extensive interstitial pulmonary calcification. These cases dramatically illustrate the capability of radionuclides to detect interstitial pulmonary calcification when radiographic demonstration is lacking. The early detection of extraskeletal calcification by bone-seeking radionuclides provides a unique opportunity, not previously available, to study metastatic calcification and the effects of treatment. (auth)

6452 POSITIVE IMAGING OF LIVER TUMORS BY DELAYED HEPATIC SCINTISCANNING WITH ACIDIC IONIC INDIUM 113m CHLORIDE. Cuaron, A.; Gordon, F.; Rodriguez, C. (Hospital General, Mexico City). Amer. J. Roentgenol., Radium Ther. Nucl. Med.; 122: No. 2, 318-326(Oct 1974).

Liver scintigraphy with ^{113m}In–Fe colloid can be considered a routine method for the localization of intrahepatic lesions, and liver scanning of the distribution of hepatic blood pool with ionic, acidic, carrier-free ^{113m}In–chloride may be used optionally to obtain more precise information on the degree of vascularity and blood flow in the interior of the lesion, thereby improving the probability of reaching a differential diagnosis between tumors and other space-occupying lesions of the liver. In case of remaining doubts, the scan may be repeated 6 hours later in order to depict the positive concentration of the radiopharmaceutical at the site of the tumor. (auth)

6453 SIGNIFICANCE OF A PALPABLE LIVER. A Correlation of Clinical and Radioisotope Studies. Rosenfield, A. T.; Laufer, I.; Schneider, P. B. (Beth Israel Hospital, Boston). Amer. J. Roentgenol., Radium Ther. Nucl. Med.; 122: No. 2, 313-317(Oct 1974).

Hepatic palpation is routinely performed and widely used to diagnose liver enlargement. The liver scan can give a measure of liver size that correlates well with autopsy findings. Methods to evaluate liver size on radioisotope scan using multiple levels of background erase, planimetry, and area and volume calculations have all been advocated. Results are reported from ^{198}Au–colloid and ^{99m}Tc sulfur colloid scans that show that a single vertical measurement made at a point halfway between the xiphoid and right liver margin has excellent correlation with hepatic disease. (CH)

6454 METABOLISM OF ^{14}C-LABELLED SUMITHION, O, O-DIMETHYL O-(3-METHYL-4-NITROPHENYL) PHOSPHOROTHIOATE IN APPLES. Hosokawa, Shunji; Miyamoto, Junshi (Sumitomo Chemical Co. Ltd., Osaka (Japan)). Jap. Anal.; 39: No. 2, 49-53(May 1974).

To assess biodegradability and metabolism of Sumithion in apples, radioactive Sumithion labelled with carbon-14 at the m -methyl group was applied to apple fruits in the field. The rate of decrease of Sumithion was very rapid during 3 days after treatment, approximately 60% of the applied dosage disappeared during the period. The amounts of Sumithion residue on and in apples were 1.12 ppm on the 7th day, 0.67 ppm on the 14th day, and 0.52 ppm on the 21st day. The major degradation products on the surface were Sumioxon and p -nitrocresol. Sumioxon residue was highest after 3 days, and the amount was approximately 0.02 ppm. Traces of S-methyl Sumithion were also found at 3 days. Metabolism of Sumithion in the apple proceeded slowly and water soluble metabolites were gradually increased with time. The glucoside of p -nitrocresol was found among the metabolites, which suggests that p -nitrocresol derived from Sumithion was conjugated with glucose. (auth)

6455 STUDIES ON RECEPTOR-INTRINSIC FACTOR-VITAMIN B_{12} COMPLEX. Investigation on Involvement of Ca^{2+} By Using ^{45}Ca Ion. Fujii, Terumi (Kurume Univ., Fukuoka (Japan). School of Medicine). Bitamin; 48: No. 5-6, 237-240(Jun 1974). (In Japanese).

Involvement of Ca^{2+} ion in the formation of macromolecular complex of vitamin B_{12}, intrinsic factor and receptor prepared from rat ileum mucosa was investigated by using ^{45}Ca ion and ^{57}Co-B_{12}. Filtration of the complex through Biogel column revealed that the eluted position of ^{57}Co coincided with that of ^{45}Ca. By the treatment of this complex with EDTA, the position of ^{45}Ca in the eluent shifted to that of free ^{45}Ca ion. These results indicate that ^{45}Ca is bound to this complex and plays an important role in the formation of B_{12}-intrinsic factor-receptor complex. (auth)

6456 THE FATE OF ENDOGENOUS GIBBERELLINS AND APPLIED RADIOACTIVE GIBBERELL IN A_3 DURING NATURAL AND ETHYLENE-INDUCED SENESCENCE IN CITRUS PEEL. Goldschmidt, E. E.; Galily, D. (Hebrew Univ., Rehovoth (Israel). Faculty of Agriculture). Plant Cell Physiol. (Tokyo); 15: No. 3, 485-491(Jun 1974).

The fate of gibberellins (GAs) was studied in the flavedo (the external colored peel layer) of green-harvested orange fruits, during natural and ethylene-induced senescence. GA-like substances were determined by the sugar-release barley endosperm bioassay. Careful solvent partition and TLC separation were undertaken to avoid interference of abscisic acid (ABA) and other growth inhibitors with the bioassay. Three zones of GA-like activity were detected in chromatograms of the acid fraction, all of which decreased sharply after 72 hr in 35 μ l/liter ethylene. Tritium-labeled gibberellin A_3 (^{3}H-GA_3) was applied to fruits at 5.6 mg/liter. After 5 days storage in air or ethylene, 28.5 and 20.2 percent, respectively, of extractable radioactivity were recovered as ^{3}H-GA_3, whereas 37.0 and 59.7 percent, respectively, had been converted into water-soluble compounds. The significance of GA metabolism in senescent plant organs is discussed. (auth)

6457 GLUCOSE METABOLISM IN DETACHED LEAVES OF TOMATO PLANTS GROWN WITH AMMONIUM AND NITRATE AS NITROGEN SOURCES. Ikeda, Motoki; Yamada, Yoshio; Harada, Togoro (Kyushu Univ., Fukuoka (Japan). Faculty of Agriculture). Soil Sci. Plant Nutr. (Tokyo); 20: No. 2, 185-194(Jun 1974).

The metabolism of exogenous glucose-^{14}C in the light and the dark was studied in the detached leaves of tomato plants grown with nitrogen of ammonium and nitrate. In the light, $^{14}CO_2$ release and incorporation of glucose into insoluble materials were hardly affected at all by the nitrogen sources. Among the soluble labelled

amino acids, serine had the greatest amount of label in the ammonium-plants while aspartate had the greatest amount in the nitrate-plants. This aspartate was synthesized from C_3-compounds by carboxylation. During dark-light transition, the change in the composition of soluble amino acids was more rapid in the ammonium-plants than in the nitrate-plants. In the dark, $^{14}CO_2$-release, which was ten times as much as in the light, was larger in the ammonium-plants than in the nitrate-plants; but the synthesis of high molecular compounds from glucose in the ammonium-plants was about half that in the nitrate-plants. So, it is considered that respiration operates sufficiently in the ammonium-plants. The effects of DCMU and a 100% O_2 atmosphere on glucose metabolism in both groups of plants were studied and the respiration of leaves in the light was discussed. (auth)

6458 COLLIMATION AND SURFACE COUNTING IN HAEMATOLOGY. Bowring, C. S.; Glass, H. T. (Hammersmith Hospital, London). J. Clin. Pathol.; 27: No. 9, 751-756(Sep 1974).

The effect on the results obtained in surface counting investigations of using a dual detector counting system and multihole collimators has been investigated. The sue of the additional detector resulted in smoother curves for the uptake of the radionuclide and the use of multihole collimators increased the discrimination of the counting system against the effects of radioactivity outside the region of interest. In a clinical trial to compare multihole collimation with conventional single hole collimation it was found that increased excess counts were obtained over the spleen with the multihole collimators in eight of ten cases. (auth)

6459 COMPUTATION OF RADIOIMMUNOASSAY DATA USING SEGMENTALLY LINEARIZED STANDARD CURVES. Livesey, J. H. (Princess Margaret Hospital, Christchurch, N. Z.). Comput. Biomed. Res.; 7: No. 1, 7-20(Feb 1974).

A scheme for the calculation of the results of radioimmunoassays is described which does not require exact linearization of the standard curve. For the standards, a transformation related to the logit but without the extreme heteroscedacity of the logit is used. The resulting approximately linear standard curve is fitted, beginning at one end, as sequential straight-line segments. The fitted straight lines overlap and are each as long as is consistent with linearity. Methods are given for estimating the weighted hormone concentration and confidence limits for samples run at multiple dilutions. An approximate test for parallelism between dilutions of sample and standard is described. Differing nonspecific binding between samples may be allowed for. A computer program for performing the calculations is outlined. (auth)

MATERIALS

Ceramics and Cermets

Refer also to abstracts 5935, 6545–6547, 6686, 7559, 7613–7615, 7618, 7619, 7621, 7651, and 7760.

6460 (BNL-19088) APPLICATION OF ION IMPLANTATION TO THE STUDY OF DIFFUSION OF BORON IN SILICON. Crowder, B. L.; Ziegler, J. F.; Morehead, F. F.; Cole, G. W. (Brookhaven National Lab., Upton, N. Y. (USA)). 1972. 8p. (CONF-721226-2). Dep. NTIS $4.00.

From third international conference on ion implantation in semiconductors and other materials; New York, New York, USA (11 Dec 1972).

Implantations of ^{10}B were employed in conjunction with analysis of B depth distributions with the nuclear reaction, $^{10}B(n,^4He)^7Li$, to investigate the diffusion of B in Si in the temperature range 900 to 1100°C for times of the order of 30 to 120 minutes. The diffusion constant, D, in Si was found to depend upon the B concentration. In order to evaluate the dependence of D upon B concentration, a series of isoconcentration experiments were conducted in which a "flat" ^{11}B distribution was produced by multiple energy ion implantations followed by a "tracer" implant of ^{10}B. At 1000°C and a B concentration of 10^{20} cm^{-3}, D is an order of magnitude larger than the intrinsic value of 1.5×10^{-14} cm^2/s. In Si heavily doped with As(2×10^{20} cm^{-3}), the diffusivity of B is an order of magnitude lower than the intrinsic value. These results can be interpreted by a model in which the B diffusivity in Si is a function of the Fermi level. (auth)

6461 (CONF-740724-3) DEFORMATION MECHANISM MAPS: A REVIEW WITH APPLICATIONS. Notis, M. R. (Lehigh Univ., Bethlehem, Pa. (USA). Dept. of Metallurgy and Materials Science). 1974. Contract AT(11-1)-2408. 23p. Dep. NTIS $4.25.

From symposium on plastic deformation of ceramics; University Park, Pennsylvania, USA (Jul 1974).

Deformation mechanism mapping has recently evolved as a method for quantitatively expressing complex deformation equations while at the same time allowing visual insight into understanding of these deformation processes. Techniques for the generation of deformation mechanism maps are described, specific applications in the literature to date are reviewed, and some applications not previously considered are presented. These include the examination of sequential dependent deformation processes, grain boundary sliding, and the use of deformation mechanism maps to interpret pressure-sintering kinetics. (auth)

6462 (COO-1441-26) STUDY OF THE DEFECT STRUCTURE OF "PURE" AND DOPED NONSTOICHIOMETRIC CeO_2. Progress Report, January 1, 1974–December 31, 1974. Blumenthal, R. N. (Marquette Univ., Milwaukee, Wis. (USA). Coll. of Engineering). 1974. Contract AT(11-1)-1441. 35p. Dep. NTIS $4.75.

Electrical conductivity and thermogravimetric measurements were made on SrO-doped nonstoichiometric cerium dioxide (i.e. $Ce_{1-y}Sr_yO_{2-y-x}$) as a function of temperature (~700 to 1500°C) and oxygen partial pressure (~1 to 10^{-21} atm). Assuming limiting case defect models the ionic, σ_i, and electronic, σ_e, conductivities were calculated from this data. In the region where $y \gg x$ (i.e. at low temperatures and high oxygen pressures) the following equation was obtained $\sigma_i = 4.5 \pm 0.5$ [m/o SrO] $\exp^{-0.58eV/kT}$. In the composition region between approximately $x = 10^{-3}$ and $x = 10^{-2}$, both the thermodynamic behavior and the electrical conductivity were shown to be consistent with a defect model involving randomly distributed doubly ionized oxygen vacancies and electrons localized on normal cerium sites. In this region σ_e varies linearly with x and the electronic mobility decreases with increasing SrO content. An electrochemical cell technique was used to measure the ionic transference number of CeO_{2-x} doped with 10 mole % CaO (i.e. $Ce_{1-y}Ca_yO_{2-y-x}$) as a function of temperature and P_{O_2}. The transference data, $t_i = t_i(P_{O_2},T)_{y=0.1}$ was combined with the electrical conductivity and thermodynamic data to obtain the dependence of the electronic and ionic conductivities on composition and temperature. At high oxygen pressures the electronic conductivity is p-type and the electrical conductivity is predominantly ionic. The ionic conductivity in this region is controlled by the dopant concentration (i.e. $y \gg x$). As the partial pressure of oxygen decreases σ_e exhibits a minimum and at very low oxygen pressures conduction is predominantly electronic (n-type). In the composition region $10^{-3} < x < 10^{-2}$, $\sigma_i \propto x$. The electronic conductivity of the CaO-doped CeO_2 specimen exhibits a similar dependence on x as "pure" CeO_2, except the magnitude of σ_e is lower and at smaller values of x the electronic conductivity exhibits a nonlinear dependence on x. Thermogravimetric measurements were performed on specimens of CeO_2 doped with 1 and 7 mole % SrO, 14 mole % La_2O_3 and 14 mole % Y_2O_3 as a function of P_{O_2} and T. From these data the deviation from stoichiometry $x = x(T,P_{O_2})$ was determined. The thermodynamic quantities $\Delta\bar{H}_{O_2}$ and $\Delta\bar{S}_{O_2}$ were calculated in the region $0.001 \leq x \leq 0.2$ and found to be independent of temperature. In the composition region near stoichiometry the variation of $\Delta\bar{S}_{O_2}$ with log x is consistent with the same nonstoichiometric defect model as proposed for "pure" and CaO-doped CeO_2. (auth)

6463 (ORNL-tr-2837) STABILIZED RARE EARTH OXIDES. de Kler, J. J. (Stichting Reactor Centrum Nederland, The Hague). 29 Apr 1969. Translation by M. Gerrard of Netherlands Patent 6,714,609. 4p. Dep. NTIS $4.00.

A method is described for stabilizing rare earth oxides applied as ceramic materials, especially at high temperatures. At temperatures considerably higher than the melting point of uranium, rare earth oxides undergo a phase transition. Dysprosium oxide, for example, above 1860°C is converted from a cubic to a monoclinic crystal structure, the transition being accompanied by a 10% volume change and an increase in the coordination number from 6 to 7. Gadolinium, samarium, erbium, and europium oxides undergo similar phase changes at high temperatures. A procedure is described to effect stabilization against such unwanted volume change in transformation to the cubic phase. (JRD)

6464 A NEW PRODUCTION LINE FOR CARBIDIC NUCLEAR FUEL IN THE PLUTONIUM LABORATORY OF GESELLSCHAFT FUER KERNFORSCHUNG m.b.H. AT KARLSRUHE. Guenther, E. (Kernforschungszentrum Karlsruhe (F.R. Germany). Inst. fuer Material- und Festkoerperforschung). G-I-T (Glas- Instrum.-Tech.) Fachz. Lab.; 18: No. 7, 700-705(Jul 1974). (In German). 15 figs.; 2 refs.

The construction of a UC–PuC production unit was taken up in the plutonium laboratory of the Institut fuer Material- und Festkoerperforschung. By the end of 1973, the production line was completed to such an extent that after a trial phase of the single components and of the whole system, it could be put into operation. The essential components of this system are presented and their functions described. (GE)

6465 SILICON NITRIDE–MATERIAL OF THE FUTURE. Semmler. Chem.-Anlagen Verfahren; No. , 80-87(Mar 1974). (In German).

2 figs.; 3 tabs.

Oxide ceramic materials are being used in the construction of machines and equipment in the chemical and in the electronic industry due to their excellent wearability, chemical and thermal stability and electrical insulation. Further oxide ceramic materials are other metal oxides such as for example titanium dioxide, zirconium oxide, magnesium oxide, spinel. The conventional oxide ceramic materials only endure small temperature change stresses. Furthermore, tolerances smaller than ±1% cannot be obtained with parts after sintering. The tolerances can only be improved by an expensive diamond finishing. The new ceramic material silicon nitride (Si_3N_4) is part of the interesting material developments in recent years because it is distinguished by the following properties: (1) Very high resistance to temperature changes, (2) very high resistance to corrosion, (3) high stability (hot pressed), and (4) narrow region of tolerance of parts after sintering (without finishing). Silicon nitride is thus a material of the future still open to many fields of application. (GE)

6466 ESTIMATION OF THE BOILING POINTS OF LANTHANIDE SESQUIOXIDES. Benezech, G.; Coutures, J. P.; Foex, M. (CNRS, Odeillo, France). J. Less-Common Metals; 38: No. 2/3, 131-136(1974). (In French).

The normal boiling points of rare-earth metal sesquioxides were estimated from experimental vapor pressure data obtained with a transpiration apparatus working in the temperature range 2200 to 2700°K. The vapor pressures were evaluated on the assumption that the species present are Ln(g), LnO(g), O_2(g) and O(g). A proportionality between the lattice energy ($-U_0$) and the absolute boiling point has been verified; the same is also true for the absolute melting point. In both cases the relationship of the melting or boiling point to the Z value shows an anomaly for Gd_2O_3 which is probably due to the electronic configuration of the Gd^{3+} ion ($4f^7$). (auth)

6467 FERROMAGNETISM IN ALLOYS FORMED BETWEEN URANIUM TETRABORIDE AND THE TETRABORIDES OF LANTHANUM AND LUTETIUM. Hill, H. H.; Giorgi, A. L.; Szklarz,

E. G.; Smith, J. L. (Los Alamos Scientific Lab., NM). J. Less-Common Metals; 38: No. 2/3, 239-244(1974).

The onset of ferromagnetism in samples prepared in an arc furnace was detected using an ac mutual inductance bridge operating at 17 Hz. The temperature of the maximum in the deflection curve was taken to be the Curie point. The transition temperatures and relative signal strengths (in the annealed condition) for the alloys are tabulated. Lattice parameters are represented in graphs. (JRD)

6468 FORMATION OF TANTALUM OXIDE BY CHEMICAL VAPOR DEPOSITION. Takahashi, T.; Itoh, H. (Nagoya Univ., Japan). J. Less-Common Metals; 38: No. 2/3, 211-219(1974).

A tantalum oxide (β-Ta_2O_5) film of 2 to 30 μm thick was obtained by chemical vapor deposition. The reactant gas was composed of a mixture of $TaCl_5$, O_2, and Ar. An adherent and uniform film was formed on (100) and (111) Si wafers in the temperature range 900 to 1300°C and at a flow-rate of O_2 to $TaCl_5$ (r_f) > 5, while $TaSi_2$ tended to be formed at a temperature below 1000°C and at r_f < 5. Crystalline β-Ta_2O_5 in the form of prisms or whiskers were grown under certain restricted conditions of temperature and gas concentration. The β-Ta_2O_5 film obtained at 1200°C was found to have the crystallographic ⟨010⟩ preferred orientation. (auth)

6469 THERMAL EXPANSION, DEBYE TEMPERATURE, AND GRUNEISEN CONSTANT OF CARBIDES AND NITRIDES. Ajami, F. I. (Univ. of Pennsylvania, Philadelphia); MacCrone, R. K. J. Less-Common Metals; 38: No. 2/3, 101-110(1974).

The experimental data on the thermal expansion of the carbides and nitrides of the early transition metals (with B1 structure) were collected and evaluated, and average curves of α against temperature and composition were determined. Some of the difficulties encountered in making good thermal expansion measurements peculiar to this class of compounds are briefly discussed. The resultant values of α, together with the experimental specific heat and elastic constants, are used to determine the temperature dependence on the Debye temperature and the Gruneisen constant. (auth)

6470 REVIEW OF THE FRENCH CARBIDE IRRADIATION PROGRAM. Mikailoff, H. (CEN, Fontenay-aux-Roses, France); Ravier, J.; Lallement, R. Trans. Amer. Nucl. Soc.; 19: 84(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6471 CURRENT SNR ADVANCED FUELS AND MATERIALS PROGRAM. Karsten, G. (Gesellschaft fuer Kernforschung, Karlsruhe, Ger.). Trans. Amer. Nucl. Soc.; 19: 84-86(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6472 ADVANCED FUEL AND MATERIALS: THE IMPACT ON PLANT DESIGN. Mangus, J. D.; Dyos, M. W. (Westinghouse Electric Corp., Madison, PA). Trans. Amer. Nucl. Soc.; 19: 86-87(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6473 FUNDAMENTAL RESULTS OF IRRADIATED CARBIDES: FISSION PRODUCT RELEASE, FUEL SWELLING, AND EVOLUTION OF COMPOSITION. Mikailoff, H. (CEN, Fontenay-aux-Roses, France). Trans. Amer. Nucl. Soc.; 19: 89-90(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6474 STEADY-STATE IRRADIATION BEHAVIOR OF HELIUM-BONDED URANIUM-PLUTONIUM CARBIDE. Latimer, T. W.; Barner, J. O.; Kerrisk, J. F.; Green, J. L. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 91(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6475 STEADY-STATE IRRADIATION BEHAVIOR OF SODIUM-BONDED URANIUM-PLUTONIUM CARBIDE. Barner, J. O. (Los Alamos Scientific Lab., NM); Latimer, T. W.; Kerrisk, J. F.; Bost, D.; Green, J. L. Trans. Amer. Nucl. Soc.; 19: 91-92 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6476 TRANSIENT IRRADIATION BEHAVIOR OF SODIUM- AND HELIUM-BONDED CARBIDES. Kerrisk, J. F.; Clifton, D. G.; Green, J. L. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 92-93(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6477 PROOF TESTING PROTOTYPE CARBIDE FUEL IN FTR. Vitti, J. A.; Doherty, P. K.; di Lauro, G. F.; Gilbertson, J. C.; Stuteville, D. W. (Combustion Engineering, Windsor, CT). Trans. Amer. Nucl. Soc.; 19: 93-94(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6478 REVIEW OF URANIUM SELF-DIFFUSION IN URANIUM MONOCARBIDE. Routhbort, J. L. (Argonne National Lab., IL); Matzke, H. Trans. Amer. Nucl. Soc.; 19: 100-101(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6479 SINTERING OF (U, Pu)N AS A FUNCTION OF TEMPERATURE AND NITROGEN PRESSURE. Tennery, V. J.; Bomar, E. S. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 101-102(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6480 URANIUM-MOLYBDENUM ALLOY FUELS FOR PULSED REACTORS. Taub, J. M. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 131(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6481 FAST-FLUX-IRRADIATION DATA ON THE STOICHIOMETRY DEPENDENCE OF FUEL/CLADDING CHEMICAL INTERACTION IN MIXED-OXIDE FUEL RODS. Ellis, J. A.; Hilbert, R. F. (General Electric Co., Sunnyvale, CA). Trans. Amer. Nucl. Soc.; 19: 134-135(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6482 COMPARISON OF COPRECIPITATED AND PHYSICALLY MIXED UO_2-PuO_2 FUEL AT 8 AT. % BURNUP. Hilbert, R. F.; Evans, S. K. (General Electric Co., Sunnyvale, CA). Trans. Amer. Nucl. Soc.; 19: 135-136(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6483 INFLUENCE OF BURNUP ON HEAT-RATING-TO-MELTING FOR UO_2-PuO_2 FUEL. Leggett, R. D.; Baker, R. B.; Dutt, D. S.; Chastain, S. A. (Westinghouse Electric Corp., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 136-137(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6484 PARAMETRIC APPROACH TO THE RELEASE OF FISSION GAS FROM (U, Pu)O_2 IRRADIATED IN EBR-II. Johnson, D. L.; Hofman, G. L. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 138(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6485 CORRELATED FISSION GAS RELEASE MODEL FOR UO_2 AT HIGH TEMPERATURES. Beyer, C. E.; Hann, C. R. (Battelle-Northwest Lab., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 139-140(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6486 UO_2-Zr PERFORMANCE EVALUATION IN OVERPOWER TESTING AT 21,000 MWd/MT UO_2. Knudsen, P.; Bryndum, K. (Danish Atomic Energy Commission, Roskilde, Denmark). Trans. Amer. Nucl. Soc.; 19: 140(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6487 SCANNING ELECTRON MICROSCOPY OF UO_2 FUEL PELLETS SUBJECTED TO RAPID TRANSIENT HEATING THROUGH THE MELTING POINT. Worzala, F. J. (Univ. of Wisconsin, Madison); Bhattacharyya, S. K.; Casper, R.; Foell, W. K. Trans. Amer. Nucl. Soc.; 19: 141-142(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6488 MAGNETIC PHASE DIAGRAM OF THE UAs-UP SYSTEM. Troc, R. (Inst. of High Temperature and Structural Research, Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci. Chim.; 22: No. 7, 613-619(Aug 1974).

The magnetic phase diagram of the $UAs_{1-x}P_x$ system ($0 < x < 1$) was investigated by magnetic susceptibility measurements at temperatures 4.2 to 300°K. The temperature of the phase transition from magnetic ordering of types IA to I decreased monotonously from 64°K for stoichiometric UAs to 23°K for $UAs_{0.25}P_{0.75}$. Above $x = 0.75$ only type I existed, and the temperature of the moment-jump transition was independent of composition being equal to 23°K as for pure UP. For the $x < 0.75$ samples a wide range of the simultaneous existence of magnetic structures of types I and IA was found. The Néel temperatures showed a flat minimum for the compositions close to $x = 0.55$. (auth)

6489 ELECTRICAL RESISTIVITY OF UP AND UAs. Troc, R.; Kletowski, Z. (Inst. of High Temperature and Structural Research, Wroclaw). Bull. Acad. Pol. Sci., Ser. Sci. Chim.; 22: No. 7, 621-624(Aug 1974).

Electrical resistivity measurements on polycrystalline UP and UAs were carried out over the temperature range 4.2 to 300 K. Apart from the usual anomalies at T_N, a jump in the resistivity at 22°K for UP and a hump-backed maximum at 64°K for UAs were found. Low-temperature anomalies for both compounds were observed in the temperature-dependence of the resistivity, due to the earlier reported magnetic effects occurring at these temperatures. (auth)

6490 CONCENTRATION DEPENDENCE OF ABRASIVE PROPERTIES IN POWDERS OF TITANIUM AND ZIRCONIUM MELTED CARBIDES. Samsonov, G. V.; Stepanchuk, A. N.; Pritulyak, A. S.; Shlyuko, V. Ya.; Adamovskii, A. A.; Mashonkina, T. V. (Kiev Polytechnical Inst.). Porosh. Met., Akad. Nauk Ukr. SSR; No. 9, 56-61(Sep 1974). (In Russian).

Abrasive characteristics of polished grains were studied for melted carbide phases of titanium and zirconium as dependent on bound carbon content in them. It is shown that titanium carbide phases with the ratio C/Me above 0.75/0.70 and zirconium carbide of stoichiometric composition are shown to have the highest abrasive ability. (auth)

6491 EFFECT OF THERMOMECHANICAL TREATMENT ON STRENGTH OF NICKEL REINFORCED WITH ZrO_2. Denisenko, E. T.; Olifirovich, Ya. V.; Kostenko, A. D. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 9, 85-90(Sep 1974). (In Russian).

Investigation of sheet nickel strengthened with dispersed inclusions of zirconium dioxide and possessing an increased strength and stable substructure resulted from thermomechanical treatment. The results of tests for short-term strength radiographic and microstructural investigations are presented. (auth)

6492 EFFECT OF OXYGEN CONTENT IN URANIUM OXYCARBIDES ON THEIR STRUCTURAL CHARACTERISTICS. Larin, A. A.; Vlasov, V. G. (Ural Polytechnic Inst., Sverdlovsk, USSR). Porosh. Met., Akad. Nauk Ukr. SSR; No. 9, 91-94(Sep 1974). (In Russian).

An effect of oxygen content in uranium oxycarbides was investigated as applied to their certain structural characteristics. Uranium oxycarbides are shown to possess a defective crystal lattice with ordered arrangement of vacancies. An increase in the number of the vacancies in both sublattices and a decrease in the crystal lattice parameter with a rise of oxygen content in oxycarbide are explained by the existence of Me-Me (metal-metal)- and Me-X (metal-metaloid) interactions. (auth)

6493 INFLUENCE OF URANIUM DIOXIDE THERMAL PROCESSING ON ^{133}Xe RELEASE VELOCITY. Klima, J.; Podest, M.; Vins, V.; Jakesova, L. (Nuclear Research Inst., Rez, Czech.). Jad. Energ.; 20: No. 9, 297-305(Sep 1974). (In Russian).

An influence of the thermal processing of uranium dioxide on the velocity of ^{133}Xe release is described. The effect of different grain size of UO_2 obtained from standard 94% TD ceramic material in course of additional sintering up to 98% TD on ^{133}Xe release velocity was studied. The influence of the additional sintering at various temperatures and dwell times is discussed in terms of non-equilibrium thermodynamics. (auth)

6494 INVESTIGATION OF FORMATION KINETICS FOR HAFNIUM NITRIDE IN NITROGEN AND AMMONIA FLOWS. Lyutaya, M. D.; Kulik, O. P.; Timofeeva, I. I. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 9, 6-10(Sep 1974). (In Russian).

Kinetics of powdery hafnium nitride (particle size is not more than 30 μ) formation by reaction with nitrogen and ammonia is described by a pseudotopokinetic equation. The kinetic parameters are calculated for hafnium nitride formation in nitrogen and ammonia flows. Rate of nitride formation in ammonia is lower than that in nitrogen due to formation and decomposition of intermediate products-nitridohydrides. The hafnium nitride homogeneity domain, which is in the range of $HfN_{0.50}$-$HfN_{1.0}$ composition, is determined applying chemical and x-ray methods. No formation of the lower hafnium nitride of the Me_2N type within a temperature range of 600 to 1200°C was found. (auth)

6495 INTERACTION OF LAVES PHASES WITH GROUP IV-V TRANSITION METAL CARBIDES. Eremenko, V. N.; Velikanova, T. Ya.; Shabanova, S. V. (Inst. of Material Behavior Problems, Kiev). Metallofizika; No. 52, 87-89(1974). (In Russian).

Thermodynamic analysis and experimental data on phase equilibria in the systems Me(V-VII)-Me(IV,V)-C lead to the conclusion that generally in these systems sections of the Laves phase-transition metal carbide are not quasibinary. (SJR)

6496 INTERACTION OF $HfMo_2$ WITH HAFNIUM CARBIDE. Eremenko, V. N.; Shabanova, S. V.; Velikanova, T. Ya. (Inst. of Material Behavior Problems, Kiev). Metallofizika; No. 52, 89-94(1974). (In Russian).

A study was made of phase equilibria in the Mo-HfC-Hf system in the temperature interval from 1400°C to melting. The melting temperature of the phase based on $HfMo_2$ is increased on dissolving carbon from 2040°C in the Hf-Mo system to 2100°C in the ternary Mo-Hf-C system. A semithermic section of the $HfMo_2$-HfC region is constructed. (SJR)

6497 COATING MICROSPHERES WITH ZIRCONIUM CARBIDE-CARBON ALLOY BY IODIDE PROCESS. Ikawa, K.; Iwamoto, K. (Japan Atomic Energy Research Inst., Tokai). J. Nucl. Sci. Technol. (Tokyo); 11: No. 6, 263-267(Jun 1974).

Simultaneous deposition of carbon and zirconium from vapor produced by the reaction between methyl iodide vapor and zirconium sponge was studied with the application of a spouted bed constituted by a funnel carrying a charge of alumina microspheres, which were blown upward and held in dynamic suspension by a jet of the vapor and gases spouting from the funnel. The purpose of the experiment was to determine the conditions favorable for obtaining a coat of zirconium carbide-carbon alloy on the microspheres. Deposition of the vapor on the microspheres, leading to the formation of the carbon alloy coating, was found to take place at temperatures exceeding 1,100°C. The C/Zr ratio of the deposited coat was found to increase with deposition temperature. The hydrogen concentration in the spouting gas affected both the deposition yield and the chemical composition of the deposit. Repeated use of the sponge was found to impair its performance due to deactivation by premature deposition of carbon. (JA)

6498 MAGNETIC PROPERTIES OF THE ALLOYS UB_4-DyB_4 AND UB_4-ErB_4. Ali-Zade, N. Kh.; Ramazanzade, M. G.; Chechernikov, V. I.; Guseinov, N. G.; Slovyanskii, V. K. Uch. Zap., Azerb. Inst. Nefti Khim., Ser. 9; 9: No. 8, 54-56(1972). (In Russian).

Magnetic properties were determined for the compounds DyB_4 and ErB_4 and for the UB_4-DyB_4 and UB_4-ErB_4 alloys containing 5 to 90 mol.-% of the second component, over the range 77 to 500°K. At temperatures above that of liquid N the two compounds are paramagnetic with the susceptibility, χ, obeying the Curie-Weiss law. Their magnetic properties are explained on the basis of 4f electron localization. With the UB_4-DyB_4 alloy an increase in concentration of DyB_4 shifts the maximum on the χ/temperature curve towards lower temperature and with DyB_4 > 70% the maximum is below the liquid-N temperature. The UB_4-ErB_4 system behaves similarly. The Néel temperature shifts to higher temperature with these alloys as the magnetic field strength is reduced (as with rare earths and UB_4-ThB_4 alloys). As U atoms are replaced by Dy or Er atoms there is a regular change in magnetic properties with antiferromagnetism existing over the whole concentration region. (Referativnyi Zh.)

6499 p-T PHASE DIAGRAM OF A URANIUM-NITROGEN SYSTEM. Levinskii, Yu. V. At. Energ. (USSR); 37: No. 3, 216-219(Sep 1974). (In Russian).

On the basis of an analysis of equilibrium conditions in a uranium-nitrogen system, a new variant of the p-T phase diagram of this system is presented. Typical isobaric and isothermal sections of the spatial p-T-x phase diagram are considered. (tr-auth)

6500 URANIUM SWELLING DURING LOW-TEMPERATURE IRRADIATION TO HIGH BURN-UP. Voloshchuk, A. I.; Golovchenko, Yu. M.; Zavgorodnii, A. Ya.; Zelenskii, V. F.; Konotop, Yu. F. At. Energ. (USSR); 37: No. 3, 212-215(Sep 1974). (In Russian).

The results of post-irradiation investigation of metallo-ceramic uranium alloys irradiated to 3.3 at.% burnup with a fission rate of $9 \cdot 10^{13}$ fissions/cm$^3 \cdot$ s at an average temperature of about 300°C are presented. The common nature of mechanisms of uranium swelling under the investigated conditions and vacancy swelling of structural materials during irradiation by fast neutrons is discussed. The conservation of the effect of initial alloying in low-alloyed uranium alloys during the burnup achieved is noted. (auth)

6501 PRESSURE DEPENDENCE OF THE SUPERCONDUCTING TRANSITION TEMPERATURE OF Th_4H_{15}. Dietrich, M.; Gey, W.; Rietschel, H.; Statterthwaite, C. B. (Univ., Karlsruhe, Ger.). Solid State Commun.; 15: No. 5, 941-943(1 Sep 1974).

Measurements of the superconducting transition temperature of

Th_4H_{15} under hydrostatic pressure up to 28 kbar are reported. The initial linear increase is found to be +42 mK/kbar. (auth)

6502 MOESSBAUER STUDIES OF EUROPIUM AND YTTERBIUM HYDRIDES. Mustachi, A. (Hebrew Univ., Jerusalem). J. Phys. Chem. Solids; 35: No. 10, 1447-1450(Oct 1974).

Moessbauer absorption spectra were obtained for the 21.6 keV transition of ^{151}Eu in EuH_2 at various temperatures and for the 84.3 keV transition of ^{170}Yb in YbH_2 at 4.1°K. The isomer shift of EuH_2 relative to Eu^{3+}: Sm_2O_3 is -12.1 ± 0.3 mm sec^{-1}, and the magnetic hyperfine field equals -305 ± 5 kOe at saturation. The Curie temperature is found to be 16.2 ± 0.05°K, and the critical parameters of the transition are $D = 1.17 \pm 0.02$ and $\beta = 0.35 \pm 0.01$. The magnetic field is perpendicular to the principal axis of the electric field gradient and the value of the quadrupole hyperfine interaction $e^2qQ_0(3\cos^2\theta - 1)/8$ is -28 ± 4 Mc sec^{-1}. A large increase of the resonance area (21%) occurs at the transition to the ferromagnetic state. The isomer shift of YbH_2 relative to Yb: $TmAl_2$ is -0.11 ± 0.01 mm sec^{-1}. The value of the quadrupole coupling constant $e^2qQ_e/4$ is -91.5 ± 2Mc sec^{-1} and the asymmetry parameter of the electric field gradient equals 0.89 ± 0.05. The data for EuH_2 and YbH_2 is shown to be consistent with the hydridic model for the rare earth hydrides. (auth)

6503 BAND STRUCTURE OF VO BY THE APW-LCAO METHOD. Kraan, D. J. (Technische Hogeschol, Delft, Netherlands). Solid State Commun.; 15: No. 6, 991-995(15 Sep 1974).

An APW-LCAO energy band calculation was carried out for f.c.c. vanadium oxide for several lattice constants and with inclusion of the vanadium 4s-orbital. The original atomic configuration used is $\{V(3d^44s^1), O(2p^4)\}$. An attempt is made to attain self-consistency by changing this configuration. (auth)

6504 RARE EARTH OXYNITRIDES LnN_xO_{1-x} (Ln = La, Pr, Tb). Brown, R. C.; Clark, N. J. (Flinders Univ. of South Australia, Bedford Park). J. Inorg. Nucl. Chem.; 36: No. 10, 2287-2290(Oct 1974).

The effect of oxygen on the lattice parameters of lanthanum, praseodymium and terbium nitrides at 1500°C was determined. Particular attention was given to sample characterization, and a simple analytical method was used for oxygen determination. The lattice parameters of lanthanum and terbium oxynitrides decrease linearly with increasing oxygen content, whereas for praseodymium a linear decrease was obtained only for oxygen contents greater than that in $PrN_{0.87}O_{0.13}$. Oxynitride preparations of erbium and holmium were inhomogeneous and Vegard plots were not obtained. (auth)

6505 TECHNIQUE FOR DETERMINING THE APPARENT DENSITY OF IRRADIATED URANIUM DIOXIDE IN FRAGMENTS. Banks, D. A.; Prestwood, J. (United Kingdom Atomic Energy Authority, Sellafield, Eng.). J. Phys., E (London); 7: No. 10, 794-796(Oct 1974).

The determination of the apparent density of uranium dioxide nuclear fuel after irradiation presents unusual problems in remote handling, since the fuel is highly radioactive and cracks into fragments when removed from the metal cladding. A technique is described by which the density of recovered fuel fragments is measured by a mercury displacement method, using specially designed pycnometers which are vacuum filled. Details are given of the equipment developed for performing the remote handling operations and consideration is given to the sources of error. Determinations are normally made to an accuracy better than ±0.5% and in special cases better than ±0.2% can be achieved. The measurements have proved to be important in understanding the processes of irradiation-sintering and fission-product swelling in the fuel. (auth)

6506 HIGH-TEMPERATURE ENTHALPIES AND STANDARD GIBBS FREE ENERGIES OF FORMATION OF THE EUROPIUM CHALCOGENIDES: EuO, EuSe, AND EuTe. McMasters, O. D.; Gschneidner, K. A.; Kaldis, E.; Sampietro, G. (Ames Lab., Iowa). J. Chem. Thermodyn.; 6: No. 9, 845-857(Sep 1974).

The enthalpies of EuO, EuS, EuSe, and EuTe were measured from 300 to 1725 K by using a copper-block drop calorimeter. High temperature values of $C_p^\circ(T)$, $S^\circ(T)$, and $-\{G^\circ(T) - H^\circ(298.15\ K)\}/T$, were calculated from the enthalpies together with the published low-temperature heat capacity for EuO and EuS and estimated entropies at 298.15 K for EuSe and EuTe. The enthalpies of formation of EuO, EuS, and EuSe, at 298.15 K, were re-evaluated and the standard Gibbs free energies of formation of all four compounds were calculated as a function of temperature. (auth)

6507 FERRO-TIC M-6 (CARBIDE BONDED BY AGE-HARDENABLE MARTENSITIC STEEL). Alloy Dig.; TS-266: 2p(Jan 1974).

Ferro-Tic M-6, M-6A, and M-6B are comprised of ultrahard TiC dispersed through a matrix of age-hardenable martensitic steels. Their respective compositions are 33, 0, 37.5, and 42.4% TiC, 12.0, 11.2, and 10.5% Ni, 5.7, 5.3, and 5.0% Co, 3.2, 2.9, and 2.5% Mo, 0.7, 0.6, and 0.5% Ti; balance Fe. They are designed for tooling applications which require high strength and toughness, and resistance to corrosion and wear. Their corrosion resistance is generally superior to that of hardenable stainless or maraging steels. They have good corrosion resistance to aggressive chemical environments containing H and chlorides. Resistance to stress corrosion cracking in aqueous NaCl solutions is similar to that of maraging steels. Data are given on their production, physical properties, hardness and rupture strength, corrosion resistance, heat treatment, machining and grinding, surface finishing, and applications. (Metals Abstr.)

6508 DENSITY CHANGES ACCOMPANYING THE ANNEALING OF WROUGHT THORIATED TUNGSTEN WIRE. Dunham, T. E. (General Electric Co., Cleveland); Hehemann, R. F. Met. Trans.; 5: No. 11, 2365-2373(Nov 1974).

Density measurements were made on 0.762 mm W-1 wt % ThO_2 wires which had been annealed at temperatures between 1000 and 2000°C for times up to 120 min. Selected specimens were examined using optical and scanning electron microscopy. The results of this study indicate that the low, as-worked wire density is a result of large cracks associated with the ThO_2 particles. Time-temperature annealing regimes, significantly below those necessary for recrystallization of the wire, result in partial healing of the cracks. This crack healing process can be followed qualitatively by observing longitudinal fracture surfaces in the scanning electron microscope and quantitatively by changes in the density of the wire. The apparent activation energy for the crack healing process was found to be 57.8 kcal/mole. The results suggest that crack closure is a result of both shear and grain boundary diffusion transport processes. It is concluded that the presence of cracks can influence the morphology of the recrystallized grains. (auth)

6509 CREEP BEHAVIOR OF A TUNGSTEN ALLOY DISPERSION STRENGTHENED BY ZrO_2. Blickensderfer, R. (Bureau of Mines, Albany, OR). Met. Trans.; 5: No. 11, 2347-2350(Nov 1974).

The creep behavior of a dispersion strengthened tungsten alloy was studied over a temperature range of 1820 to 2160°K or 0.45 to 0.56 T_m and a stress range of 24 to 138 MPa. The activation energy for creep was determined as 2.37 ± 0.07 MJ/kg°K and was not a function of stress. The steady-state creep rate varied linearly with stress at stresses below 80 MPa and as the 4.6 ± 0.1 power of stress at stresses above 100 MPa. The stress dependency did not satisfy an exponential relationship. The creep behavior satisfied the functional dependency of the Ansell-Weertman model, but the creep rates were in error by a factor of about 10^3. Nabarro-Herring creep in the low-stress region and a modification of the Ansell-Weertman theory in the high-stress region provide satisfactory agreement with experiment for this tungsten alloy as well as the SAP alloy of Ansell and Lenel. (auth)

6510 GROWTH OF NIOBIUM-NIOBIUM CARBIDE (Nb_2C) EUTECTIC AND HYPEREUTECTIC COMPOSITES BY ZONE MELTING. David, S. A.; Brody, H. D. (Univ. of Pittsburgh). Met. Trans.; 5: No. 11, 2309-2316(Nov 1974).

Growth from the melt of niobium-niobium carbide (Nb-Nb_2C) composites at the eutectic and off the eutectic composition by electron beam floating zone melting and freezing was studied. Composite growth has been successfully achieved for the eutectic composition and for compositions up to four atomic percent above the eutectic. The volume fraction of the carbide phase was increased from 26 to 33% by growing off the eutectic composition. The alignment and morphology of the carbide phase are influenced primarily by growth rate and composition. The carbide morphology may be either rod-like or plate-like. For a given composition, rod morphology is favored at higher growth rates. For constant growth rate, the plate-like morphology is promoted by increasing carbon content. The transition from plate to rod morphology is gradual. Lamellar and inter-rod spacings vary from 1 to 6 microns for growth rates varying from 5 to 90 microns per second. Variation of lamellar spacing with freezing rate, R, produces a straight line (on a log-log plot) in agreement with a relationship of the form λ^2R^n = constant, with n = 0.8. For alloys four at. % above the eutectic, primary Nb_2C dendrites nucleate and grow ahead of the still well aligned two phase solid plus liquid interface. (auth)

6511 VALENCE MIXING AND SEMICONDUCTOR-METAL TRANSITION IN THE Sm MONOCHALCOGENIDES. Campagna, M.; Bucher, E.; Wertheim, G. K.; Longinotti, L. D. (Bell Telephone Labs., Inc., Murray Hill, NJ). Phys. Rev. Lett.; 33: No. 3, 165-168(15 Jul 1974).

Sm ions in "chemically collapsed" phases of SmS, e.g., $Sm_{0.85}Th_{0.15}S$ and $Sm_{0.82}Gd_{0.18}S$, are found to be in the state of inter-configuration fluctuations. In contrast, valence fluctuations in pure SmS are shown to be not larger than 3%. Conduction-electron screening does not drastically affect either the location or the effective intra-atomic Coulomb interaction U_{eff} of 4f levels in photoemission spectra. (auth)

6512 DESIGN CONSIDERATIONS FOR TUNGSTEN CARBIDES IN STRUCTURAL APPLICATIONS. Braiden, P. M. SME Technical Paper No. MR73-917. Dearborn, MI; Society of Manufacturing Engineers (1973). 22p.

Tungsten carbides are attractive for certain structural applications because they exhibit very high strength and high Young's modulus. However, these materials can behave in a brittle manner and careful design is required if catastrophic failures are to be avoided. Experiments which have been performed on three grades of WC under uniaxial and biaxial stress conditions are described. Statistical techniques which permit these materials to be used in a reliable design philosophy are described and applied to the results obtained. Some plastic flow may be developed by certain compositions under particular loading conditions. These conditions are discussed. (Metals Abstr.)

6513 ASPECTS OF MOLYBDENUM VERSUS TUNGSTEN IN TITANIUM CARBIDE BASED CEMENTED CARBIDE AS REGARDS THE CUTTING PERFORMANCE. Ekemar, S.; Iggstrom, S.; Heden, G. SME Technical Paper No. MR73-921. Dearborn, MI; Society of Manufacturing Engineers (1973). 21p.

Cemented-carbide-based on TiC and Ni with Mo as a property improving additive has for many years been under development. It is evident that W can be used in this type of cemented carbide, with a high cutting performance as a result. Independent of the use of the two property improving elements, the behavior of cemented carbide in cutting operations follows from the influences of the two main constituents, TiC and Ni. The positive and the negative consequences of this fact are treated. (Metals Abstr.)

6514 UTILIZATION OF THE PHYSICAL PROPERTIES OF CEMENTED CARBIDES FOR MINING APPLICATIONS. Bower, A. B. Jr. SME Technical Paper No. MR-73-914. Dearborn, MI; Society of Manufacturing Engineers (1973). 14p.

Cemented carbides for the mining industry are basically straight WC-Co grades. Physical properties of these grades are controlled primarily by Co content and/or input material size (structure control) during the manufacturing cycle. Three major application areas are: rotary drilling, which includes oil and gas wells plus blast (explosives) holes, bored raise shafts and large tunneling machines; percussive drilling primarily for rock breakage (blast) holes in mines, quarries and construction; and flat-seam underground mining such as coal, salt, potash, trona, and gypsum. Each application area utilizes carbides with properties designed particularly for the ground (earth material) breaking or cutting method and equipment type used. (Metals Abstr.)

6515 ZERO-PHONON LINES AT 361 AND 413 nm PRODUCED BY PROTON IRRADIATION IN MgO. Seiyama, T.; Hiraoka, E.; Yoshida, T. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 35-36(1973).

The zero-phonon lines at 360.9 and 412.6 nm were observed to increase and to decrease respectively during irradiation with 500-keV protons. This fact suggests that the centers responsible for these centers must have different structure, in spite of their same structural symmetry. It seems that these two lines accompany the vibrational side bands at 365.8 and 417.9 nm, respectively. (auth)

6516 NEW COMPLEX BORIDES. Rogl, P.; Nowotny, H. (Vienna Univ. (Austria). Inst. fuer Physikalische Chemie). Monatsh. Chem.; 104: No. 4, 943-952(Jul 1973). (In German).

The borides $V_{0.5}Ru_{0.5}B$ and $Ni_{0.5}Ru_{0.5}B$ crystallize with FeB-type structure. The stability of these compounds with respect to the participating metals is discussed within the structurally related monoborides. $Fe_{2.2}Rh_{0.8}B$ and $Fe_{2.2}Ir_{0.8}B$ crystallize with Fe_3C-type structure. The stabilizing influence of T = Mo, W, Re, Ru, Os, Co, Rh, Ir, Pd, and Pt is investigated. (auth)

6517 AN X-RAY DIFFRACTION STUDY OF THE HEATED PRODUCTS OF NEODYMIUM OXIDE, YTTRIUM OXIDE, AND VANADIUM(III) OXIDE AT 1400 DEG C. Shin-ike, Tsutomu (Osaka Dental Coll., Hirakata (Japan)); Adachi, Gin-ya; Shiokawa, Jiro. Nippon Kagaku Kaishi; 1974: No. 6, 1038-1042(Jun 1974). (In Japanese).

The heated products of Nd_2O_3, Y_2O_3, and V_2O_3 at 1400°C in vacuo (~10^{-4} mmHg) for an hour were studied through an analysis of x-ray diffraction patterns. In the case of the $Y_2O_3-V_2O_3$ system, only a stoichiometric perovskite type mixed oxide (YVO_3) was formed. In the case of the $Nd_2O_3-Y_2O_3$ system, a crystal belonging to C-type (Sc_2O_3-type) was formed, if the mole fractions of Y_2O_3 in the reaction mixtures were above 0.65, and mixtures of both A-type (La_2O_3-type) and B-type (Sm_2O_3-type) compounds were formed, if the mole fractions of Y_2O_3 were less than 0.40. When Nd_2O_3, Y_2O_3, and V_2O_3 were heated together, lattice constants of the obtained perovskite type crystals were proportional to the mole ratios of Nd_2O_3 to Y_2O_3, if moles of $Nd_2O_3 + Y_2O_3$ were equal to moles of V_2O_3. If moles of $Nd_2O_3 + Y_2O_3$ were more than those of V_2O_3, Nd_2O_3 was incorporated more easily than Y_2O_3 into the perovskite type crystals. (auth)

Metals and Alloys

Refer also to abstracts 5931, 5932, and 7503.

6518 ZIRCONIUM IN NUCLEAR APPLICATIONS. Conference held at Portland, Oregon, August 21-24, 1973. ASTM Special Technical Publication 551. Philadelphia; American Society for Testing and Materials (1974). 536p. (ASTM-STP-551; CONF-730822-). $44.50.

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973).

Thirty-five papers were presented at the conference. A separate abstract was prepared for each of thirty-two papers. Two papers were previously abstracted in NSA as 28: 18874 and 30: 07286. (JRD)

For abstracts of individual papers see: 5931, 5932, 6533-6539, 6553, 6673-6684, and 6708-6717.

Corrosion and Erosion

Refer also to abstracts 7617 and 7635.

6519 (EURISOTOP-95) USE OF RADIOACTIVE INDICATORS FOR THE STUDY OF CORROSION. Akerman, K. (Commission of the European Communities, Brussels (Belgium). Bureau Eurisotop). Oct 1974. 81p. (In German). Dep. NTIS (US Sales Only) $7.25.

The use of radioactive tracers in the study of erosion and corrosion is discussed in some detail. The extent and effect of chemical and electrochemical corrosion is first considered. Some technical and engineering problems connected with corrosion and erosion are reviewed. The corrosion of metallic materials and of ceramic coatings is discussed. The application of radioisotopes to these problems is outlined. The effect of radiation on corrosion is considered. (JSR)

6520 (KFK-1932) CORROSION AND MECHANICAL LONG-TERM BEHAVIOUR OF CLADDING TUBES IN SODIUM OF 700°C. Borgstedt, H.; Dietz, H. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Jul 1974. 59p. (In German). Dep. NTIS (US Sales Only) $6.00.

Tube specimens of the steels no. 1.4970, 1.4981, and 1.4988 (one batch of each) were exposed in a high-temperature sodium loop for 5000 hours in sodium of 700°C and a velocity of 5 m/s (oxygen concentration <10 weight ppM). The formation of a thin (~5 μm) ferritic subsurface layer and a 35 μm thick layer with ferritic grain boundaries was independent on the material composition. A loss of boron—1.4970—and of nitrogen—1.4988—was measured. The observed corrosion rates (<5 μm/year) were small compared with earlier results. The 1.4988 showed a by 10 to 15% reduced creep strength ($\sigma_{B/5000h}$) compared with specimens tested in vacuo or argon atmosphere. The sodium exposed specimens of 1.4970 and 1.4981 also had an increased creep rate compared with unexposed material. The causes of these effects on the creep strength may be explained by effects of thermal aging. (auth)

6521 (SVF-12) FILTERABILITY OF CORROSION PRODUCTS FROM CARBON STEEL IN WATER. Influence of Temperature and Oxygen Content. Kelen, T.; Falk, I. (Aktiebolaget Atomenergi, Studsvik (Sweden)). Jun 1974. 33p. (In Swedish). Dep. NTIS (U. S. Sales Only) $5.00.

Influence of temperature and oxygen content on the filterability of corrosion products from carbon steel in water were studied in laboratory investigations. The experiments were performed in a high pressure circuit where water is first heated in a preheater, then cooled and finally filtered. The corrosion products were produced from a neutron-activated surface of carbon steel. The amount of iron was determined by measuring the gamma-radiation from Fe-59. The filterability was calculated as the ratio of the total amount of iron in the water and the amount of iron on the filter. The filterability showed a large dependence on the temperature of the filter, the temperature of the preheater and the content of oxygen. One conclusion of the results is that

it is not possible to compare values of filterability of corrosion products in cooled water samples from: (1) different parts of a high temperature system; (2) the same sample point during start up of a system; (3) two systems at different temperatures; and (4) two systems with different content of oxygen in the water. (SW)

6522 REDUCTION AND OXIDATION OF NON-STOICHIOMETRIC ANODIC OXIDE FILMS ON TANTALUM. Schulze, P.; Heusler, K. E. (Technische Univ. Clausthal, Clausthal-Zellerfeld (F.R. Germany). Abt. Korrosion und Korrosionsschutz). Ber. Bunsenges. Phys. Chem.; 78: No. 6, 601-607(Jun 1974).

8 figs.; 1 tab.; 22 refs.

While heating anodic oxide films on tantalum in vacuum at temperatures above 150°C the oxygen deficit in the oxide increases by dissolution of oxygen into the metal. At temperatures below about 100°C this reaction stops almost completely, but after admission of oxygen the oxide is reoxidized. The kinetics of reoxidation were investigated by measuring mass changes using a quartz frequency balance. At low oxygen pressures and for short times after a pressure jump the phase-boundary reaction determines the rate. At high pressures and for long times diffusion of stoichiometric defects in the oxide is rate-determining. The stoichiometric defects very probably are oxygen vacancies. The diffusion coefficient of the vacancies was determined as a function of temperature. The rate of the phase-boundary reaction is proportional to the oxygen pressure and to the vacancy concentration. The rate constant at 55°C was evaluated. The mechanism of the phase-boundary reaction is discussed. (auth)

6523 INFLUENCE OF STRUCTURE ON THE OXIDATION BEHAVIOUR OF ZIRCONIUM-VANADIUM ALLOYS. Borchers, H.; Tensi, H. M.; Maerz, G. (Technische Univ. Muenchen (F.R. Germany). Inst. fuer Metallurgie und Metallkunde). Werkst. Korros.; 25: No. 9, 637-643(Sep 1974). (In German).

11 figs.; 2 tabs.; 12 refs. Part of a thesis by G. Maerz.

The oxidation of the alloys ZrV_1 and ZrV_2 was studied on a comparative basis to zirconium after various mechanical and thermal pretreatments; the aggressive medium was steam of 300°C. It was shown that recrystallizing annealing after cold deformation has but little influence on the oxidation resistance; a considerable diminution of the oxidation susceptibility was achieved, however, by grain refining after a cold deformation or annealing of the martensitic structure. This type of treatment has a positive effect, in particular on the structure of the protective layer. In view of the fact that the oxidation susceptibility increases with the concentration of the alloying element it may be suggested that the intermetallic compound ZrV_2 has a negative effect. Consequently, the oxidation resistance is improved by quenching from high temperatures which prevents the formation of segregations. (auth)

6524 OXIDATION OF Cr-Y ALLOYS. Bobrovs'kii, O. V.; Vasyutins'kii, B. M.; Kartmazov, G. M.; Lazareva, L. S. (Physical-Technical Inst., Kharkov). Ukr. Khim. Zh.; 40: No. 2, 163-166(Feb 1974). (In Ukrainian).

Literature data on oxidation of Cr-Y alloys were reviewed, and the kinetics of oxidation of such alloys containing 0.05 to 35 at. % Y at 1200°C were studied. The electrical resistance of some of the alloys was determined. (tr-auth)

6525 EFFECTS OF STRAIN RATE ON THE IODINE-INDUCED CRACKING OF ZIRCALOY UNDER LOCALIZED STRESS CONDITIONS. Wood, J. C. (Atomic Energy of Canada Ltd., Chalk River, Ont.); London, I. M. Trans. Amer. Nucl. Soc.; 19: 105-106(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6526 DECARBURIZATION OF 2-1/4 Cr-1 Mo STEEL BY SODIUM. Klueh, R. L.; Leitnaker, J. M. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 107(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6527 DIFFERENTIAL THERMAL ANALYSIS AS A METHOD FOR STUDYING CHEMICAL REACTIONS IN LIQUID SODIUM. Charles, R. G. (Westinghouse Research Labs., Pittsburgh). Trans. Amer. Nucl. Soc.; 19: 107-108(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6528 BEHAVIOR OF LANTHANUM IN AN EQUIMOLAR MOLTEN MIXTURE OF POTASSIUM AND SODIUM CHLORIDES. Volkovich, A. V.; Lyazgin, B. I.; Potapenko, O. G. Izv. Vyssh. Ucheb. Zaved., Tsvet. Met.; No. 1, 101-103(1973). (In Russian).

The interaction of metallic La with an equimolar molten mixture of KCl and NaCl was studied at 690 to 800°C. The dissolution of the metal took place by virtue of its interaction with the alkali metal ions, obeying the equation $La + 2MeCl = LaCl_2 + 2Me$ (Me = K or Na). This was qualitatively supported by the appearance of a finely-dispersed metallic powder when the salt flux in contact with the metal was dissolved in water. The rate of dissolution V, expressed in $mg/cm^2.h$, obeyed the polythermal equation $V = 2.758 \times 10^5 \exp[-8774.9/T]$. These results agreed with existing data relating to the behavior of La in other salt mixtures with or without La^{++} ions present in them. (Metals Abstr.)

6529 KINETICS FOR THE INTERACTION OF TUNGSTEN METAL WITH HYDROGEN PEROXIDE. Artykbaev, T.; Ganiev, Sh. U.; Tsyganov, G. A.; Alimbaeva, N. (Inst. of Chemistry, Tashkent). Dokl. Akad. Nauk Uzb. SSR; No. 5, 27-28(1974). (In Russian).

Tungsten dissolves chemically in hydrogen peroxide by forming a polyperoxyacid of constant composition. Experimental results show that compact tungsten metal dissolves proportionally to time at a reaction rate of 1.6 mg-1/min, while powdered metal (200 mesh) first reacts at a high rate (300 mg-1/min), and after 30 minutes the process slows and finally stops. The reaction stops after the free hydrogen peroxide in solution is completely used up. In dissolving, the powder the reaction rate is greater than in dissolving the compact metal. The reaction rate is first order, and depends on the concentration of hydrogen peroxide in solution. The composition of the solution indicates that a peroxide compound of tungsten is formed having the empirical formula $H_2W_3O_{12}$. The possible mechanism of the process of dissolving tungsten metal in hydrogen peroxide involves the following two steps: (1) $W + 2H_2O_2 \rightarrow WO_3 + 2H_2O$ and 2) $2WO_3 + 6H_2O_2 = H_2W_3O_{11} + 5H_2O$. After the free hydrogen peroxide in solution is used up, the reaction slows down and dissolution of the metal continues in the hydrogen peroxide liberated by the following reaction: $3H_2W_3O_{11} + 7H_2O = 2H_2W_3O_{12} + 8H_2O_2$. (SJR)

6530 KINETICS AND MECHANISM OF OXIDE FORMATION AND DESORPTION FOR HIGH TEMPERATURE TANTALUM IN DISSOCIATED OXYGEN. Rosner, D. E.; Chung, H.; Feng, H. (Yale Univ., New Haven). Met. Trans.; 5: No. 11, 2305-2308 (Nov 1974).

From symposium on new developments in ferritic and duplex stainless steels; Cleveland, OH (19 Oct 1972).

Exposure of tantalum filaments between 2400 and 2800°K to non-equilibrium partially dissociated oxygen ($1.6 \times 10^{-2} \leq p_0 \leq 2.7 \times 10^{-1}$ Pa) is shown to increase both the steady-state dissolved oxygen concentration and the rate of tantalum oxide desorption. Yet the same quadratic correlation between tantalum oxide loss and dissolved oxygen concentration as observed for diatomic oxygen exposure is found to be preserved under conditions of oxygen atom impingement. This experimental observation is used to demonstrate that Rideal-type (direct atom impact) reaction steps are not responsible for metal oxide formation and desorption in the O(g)/Ta(s) system. Rather, a Langmuir-Hinshelwood (adatom interaction) reaction mechanism, combined with atomic oxygen chemisorption probabilities approximately twice those of incident molecular oxygen, suffice to explain the Ta-oxidation kinetic data reported. (auth)

6531 EFFECT OF YTTRIUM AND THORIUM ON THE OXIDATION BEHAVIOR OF NICKEL-CHROMIUM-ALUMINUM TERNARY ALLOYS. Kumar, A. Los Angeles; Univ. of California (1974). 128p. University Microfilms Order No. 74-24,594. Thesis (Ph. D.).

The effect of quaternary additions of 0.5% Y, 0.5 and 1.0% Th to a base alloy of Ni-10 Cr-5Al on the oxidation behavior and mechanism was studied during oxidation in air over the range of 1000 to 1200°C. The presence of yttrium decreased the oxidation kinetics slightly, whereas, the addition of thorium caused a slight increase. Oxide scale adherence was markedly improved by the addition of the quaternary elements. Although a number of oxides formed on yttrium-containing alloys, x-ray diffraction results and the activation energy obtained clearly showed that oxidation occurred by the diffusion of oxygen through short-circuit paths in a thin layer of alumina that formed parabolically with time. Mixed oxides containing both aluminum and yttrium formed by the reaction of Y_2O_3 to form $YAlO_3$ initially, and $Y_3Al_5O_{12}$ (YAG) after longer times. Although the scale adherence of the yttrium-containing alloys was considerably better than the base alloys, spalling did occur that was attributed to the formation of the voluminous YAG particles which grew in a "mushroom"-like manner, lifting the protective scale off the substrate locally. The YAG particles formed primarily at grain boundaries in the substrate in which the yttrium originally existed as YNi_5. This intermetallic compound reacted to form Y_2O_3, liberating metallic nickel that subsequently reacted to form NiO and/or $NiAl_2O_4$ spinel. The Y_2O_3 reacted with alumina to ultimately form the YAG "mushrooms." Thorium did not form any mixed oxides;

the only oxide involving thorium was ThO_2, which existed as small particles at the oxide-metal interface. A highly beneficial effect of the thoria particles in reducing film spalling was observed. Scale spalling in the base alloy was attributed to void formation at the oxide-metal interface, the voids forming by condensation of excess vacancies from the Kirkendall effect associated with faster back-diffusion of nickel into the substrate as aluminum was preferentially oxidized and diffused slowly outward. The mechanism of improved scale adherence in the quaternary alloys was the elimination of voids by annihilation of the Kirkendall vacancies at vacancy sinks introduced by the non-coherent interfaces between yttrium and thorium-containing intermetallics and/or oxides. (Diss. Abstr. Int., B)

6532 ACOUSTIC EMISSION AND STRESS-CORROSION CRACKING OF U–4½ WT. % Nb. Magnani, N. J. Exp. Mech.; 13: No. 12, 526-530(Dec 1973).

This relatively new method of experimental mechanics (acoustic emission) was used during stress-corrosion tests on high strength alloy U–4.5 wt % Nb in dry air, oxygen and water vapor. Specimens were tapered double-cantilevered beams with a defined groove which allowed the determination of acting stress intensity. The stress-corrosion crack velocity and the acoustic-emission count rate were measured as functions of this variable (acoustic-emission detection system from Dunegan Research Corp.). Close correlation between the measured count rate and crack velocity was found. Character of both plots against the stress intensity is very similar. The experiments allowed following conclusions: (1) the crack velocity in certain materials can be determined from acoustic-emission measurement; (2) from the measured count rate it is possible to estimate unknown stress intensities. This contribution shows a successful application of this new method of experimental mechanics and is interesting for all stress analysts and material specialists in stress corrosion problems. (Appl. Mech. Rev.)

6533 ASSESSMENT OF FRACTURE STUDIES ON ZIRCALOY-2 PRESSURE TUBES. Pickles, B. W.; Cowan, A.; Johnson, E. R. (United Kingdom Atomic Energy Authority, Risley, Eng.). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 385-399(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

It is shown that, to initiate an unstable fast fracture during operation of Zircaloy-2 pressure tubes used in the Steam Generating Heavy Water Reactor, a defect more than 4 in. long and having a depth 80 percent through the wall has to be present. The effect of hydrides oriented in both the circumferential and radial directions is discussed, and it is concluded that the hydrogen absorbed during a 30 year life should have no significant effect on the critical defect size. Similarly, it is shown that fast neutron damage will not have a deleterious effect on the critical defect size. The growth of partial thickness defects due to pressure cycling is discussed in relation to the types of defects which could be present in pressure tube or could form during operation. Overpressure tests before and during the operational life of the reactor are analyzed, and the use of periodic cold pressure tests is considered as a means of demonstrating pressure tube integrity. (auth)

6534 STRESS CORROSION CRACKING OF ZIRCALOYS IN IODINE CONTAINING ENVIRONMENTS. Cox, B. (Chalk River Nuclear Labs., Ont.). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 419-434(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Iodine solutions in organic solvents fall into two groups. First, those which, like iodine vapor at room temperature, cause crack propagation in double cantilever beam (DCB) specimens but do not initiate cracks in smooth specimens. These are solvents which form no or only weak complexes with iodine. A second group of solvents (alcohols) both initiate cracking in smooth specimens and cause crack propagation in DCB specimens. These are solvents which form strong complexes with iodine. In addition to these two groups there are a few solvents in which neither crack propagation in DCB specimens nor cracking of smooth specimens occur. Modifications to the chemistry of the system by additives were effective only for arsenite and N_2O additions to alcoholic solvents. In both instances times to failure were increased. These results are discussed in terms of the chemistry of the system, and the mechanisms operating during both crack initiation and propagation are considered. (auth)

6535 MICROSTRUCTURE OF THE OXIDE FILMS FORMED ON ZIRCONIUM-BASED ALLOYS. Sabol, G. P. (Westinghouse Research Labs., Pittsburgh); McDonald, S. G.; Airey, G. P. Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 435-448 (1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Microstructural characterization of oxide films formed on zirconium-based alloys was performed by use of scanning and transmission electron microscopy. Examination of pre-transition films formed on Zircaloy-4 oxidized in 360°C water revealed a small grain size of approximately 100 Å diameter. In addition, a gradation of grain size was observed throughout the film thickness, such that at the oxide-water surface (oldest oxide), a grain size of less than 50 Å was observed, and at the metal-oxide surface (newest oxide), the grain size was approximately 200 Å. In post-transition films the outermost oxide still possessed the very fine 50 Å diameter grain size. However, the newest oxide of post-transition films consisted of relatively large grains, with grain diameters of 1000 to 5000 Å. At the midthicknesses of these oxides intermediate grain sizes were observed. The bulk of the post-transition films was highly porous. Pore sizes ranged from approximately 10 to 150 Å, and many connected pores were concentrated at the grain boundaries. Under more severe oxidizing conditions, imposed by increasing the corrosion temperature to 427°C, the growth of large grains at the metal-oxide interface was unstable and film growth proceeded by the nucleation of finer grains. The results obtained conclusively establish the belief that the bulk of the post-transition oxide film is of nonprotective character as is obvious from the connected pore networks. A film growth model consistent with the experimental observations is that initial oxide formation is by nucleation at many sites. Growth of grains of certain orientations is favored, however, and these select grains expand in size at the expense of the less favorably oriented grains as the film thickens. Grain growth proceeds until a limiting size of 2000 to 5000 Å is reached. Further film growth induces nucleation of new grains at the metal-oxide interface. In thick scales, sequences of grain nucleation and growth are believed to occur. (auth)

6536 CORROSION AND HYDRIDING PERFORMANCE OF ZIRCALOY TUBING AFTER EXTENDED EXPOSURE IN THE SHIPPINGPORT PRESSURIZED WATER REACTOR. Hillner, E. (Westinghouse Electric Corp., West Mifflin, PA). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 449-462(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Three original blanket fuel bundles from the Zircaloy-2 clad pressurized water reactor (PWR) at the Shippingport Atomic Power Station were discharged after continuous exposure for the entire first core, consisting of one original seed and three seed refuelings, and for the first seed life of the second core. Detailed visual examinations of these components after ~4100 calendar days of operation (41 000 EFPH) revealed only the anticipated uniform gray-tan (post-transition) corrosion products with no evidence of a gross Zircaloy corrosion acceleration; all corrosion films were found to be tightly adherent to the underlying cladding. An extensive destructive evaluation of two fuel rods from each of the three fuel bundles produced greater oxide film thicknesses (7 to 12 μm or 0.28 to 0.47 mils) than the values predicted from the time-temperature history of the components (3 to 5 μm or 0.12 to 0.20 mils); an average corrosion acceleration factor of 2.4 can be calculated from the data. In slightly different terms, the observed corrosion acceleration was equivalent to raising the average surface temperature by ~40°F. The accelerated corrosion attack was accompanied by a considerably lower total hydrogen pickup than that calculated from the observed film thicknesses. This combination of an irradiation-induced corrosion acceleration and a less-than-predicted hydrogen absorption is suggestive of operation in an oxygenated environment although the Shippingport PWR coolant is maintained at a hydrogen concentration in the range 10 to 60 cc H_2/kg H_2O. (auth)

6537 CHARACTERIZATION OF ZIRCALOY OXIDATION FILMS. Urquhart, A. W.; Vermilyea, D. A. (General Electric Co., Schenectady, NY). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 463-478(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Capillary condensation measurements of the pore size distribution, transmission electron microscopy using ion micromilling to thin the oxide, and ac impedance measurements in aqueous electrolytes have been used to obtain information on the porosity and grain structure of post-transition oxide films grown in oxygen at 600°C on Zircaloy-2. The results indicate that the films contain important amounts of very fine porosity which is interconnected to the exterior surface. The impedance measurements suggest the presence of a nonporous sublayer near the oxide-metal interface. The oxide has a fine columnar grain structure at some distance from the metal and an extremely fine structure or substructure near the oxide-metal interface. (auth)

6538 FRACTURE OF ZIRCALOY-2 IN AN ENVIRONMENT CONTAINING IODINE. van der Schaaf, B. (Reactor Centrum Nederland, Petten). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 479-494(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Many Zircaloy cladding failures and the results of out-of-pile iodine stress corrosion tests are so similar as to suggest that fission of uranium produces enough iodine to attack the cladding locally. A study is presented of the effects of iodine on the fracture of Zircaloy-2 sheet being stressed locally. Disks produced from Zircaloy-2 sheet were bent biaxially by pressing an indentor into the center of the disk. The force necessary to penetrate the disks decreased when either the initial amount of iodine or the temperature was increased, for cold-worked as well as recrystallized Zircaloy-2. Uniaxial short-time creep tests and tests with stressed slotted rings, both performed in environments containing iodine, did not result in stress corrosion cracking. Microprobe analysis of the regions adjacent to cracks revealed deposition of iodine compounds on the walls of narrow cracks or near the crack tips. The propagation of the cracks in cold-worked material is affected by the manufacturing process of the sheet. The main conclusion of this investigation is that a high degree of local deformation is needed before biaxially stressed Zircaloy-2 suffers from stress corrosion by gaseous iodine. (auth)

6539 EFFECT OF SURFACE TREATMENT ON THE IRRADIATION ENHANCEMENT OF CORROSION OF ZIRCALOY-2 IN HBWR. Lunde, L.; Videm, K. (Institutt for Atomenergi, Kjeller, Norway). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 514-526(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Specimens of Zircaloy-2 have been exposed at 240°C in various locations in the primary circuit of the Halden Boiling Water Reactor (HBWR). Corrosion data have also been collected from Zircaloy-2 clad fuel elements. The radiation field caused a drastic enhancement of the attack, corrosion rates increased a hundred times, and was under normal conditions about 0.15 mg/dm^2 per day for pickled, anodized, and autoclaved material. Variations in the flux level from 2×10^9 to 3×10^{12} neutrons (n)/cm^2 · s (>1 MeV) had little influence on the corrosion rate, and it is suggested that γ-irradiation or lower energy neutrons, rather than fast neutrons, can be responsible for the corrosion enhancement. When uranium was present in the water, the corrosion rate increased for pickled and for autoclaved fuel rods, while hardly any effect was observed with anodized material. A deliberate fluoride contamination on the specimens increased the corrosion rate in-pile as well as out-of-pile. By anodizing this harmful effect of fluorides could be completely counteracted. (auth)

Preparation and Fabrication

Refer also to abstract 6763.

6540 (AD-781829) CASTING PROPERTIES OF KH17N2 STEEL PROCESSED WITH SCARCE AND RARE-EARTH METALS. Tilkonovskaya, L. D.; Braun, M. P. 10 Aug 1973. Translated from pp 185-188 of Naukova Dumka, Kiev, 1970. (FSTC-HT-23-1200-73). 6p. NTIS $4.00.

The effects of alloying and modifying elements on the castability and linear shrinkage of KH17N2 steel were studied. Cerium and mischmetal are more active modifiers than neodymium, boron, and lanthanum. KH17N2 steel which is alloyed with 1% molybdenum and modified by boron and lanthanum has an increase in castability of 17% and a decrease in linear shrinkage of 40% at a casting temperature of 1530°C. (GRA)

6541 (AEC-tr-7584) PROGRESS IN AUTOMATIC ULTRASONIC CONTROL OF AUSTENITIC STAINLESS STEEL WELDS WITH THE AID OF FOCUSED TRANSLATORS. Saglio, R.; Roule, M. Feb 1973. Translation by Isabel A. Leonard of CEA-CONF-2449. (CONF-730606-8). 6p. Dep. NTIS $4.00.

From 7th international conference and exhibition on nondestructive testing; Warsaw, Poland (4 Jun 1973).

Ultrasonic control of austenitic stainless steel welds is almost impossible with classic translators because the reflections at the grain boundaries give too low a signal-to-noise ratio. The use of focusing translators permits this signal-to-noise ratio to be improved by as much as 40 db and, in view of the fineness of the ultrasonic beam, enables the size of the defects to be shown with far greater accuracy than with a plane translator. Several examples of industrial utilization of automatic systems using focusing translators, control of weld angle, of T-weld, and pipe tap welds are given. This process opens a new path in ultrasonic control in the case of highly absorbing materials or those with high reflectivity at the grain boundaries. The size of defects can be shown more reliably and accurately. (auth)

6542 (IEA-335) APPLICATION OF NUCLEAR ENERGY IN METALLURGY AND USE OF OIL SHALES AS A REDUCTION SOURCE. Scarpinella, C. A.; Hukai, R. Y. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Apr 1974. 18p. (In Portuguese). Dep. NTIS (U. S. Sales Only) $4.00.

A progressive increase in the costs of contemporary steel making process based on the blast-furnace and LD concerters is expected, due to the increase of the coke prices in the international market. New steel making processes using direct reduction and electric furnaces are themselves based on the use of natural gas or light hydrocarbons, for which the supply in the future at steady prices is at least problematic, mainly for a country like Brazil. A steelmaking-nuclear complex based on the utilization of Brazilian oil shales for the direct reduction process is proposed, having in mind the optimal utilization of domestic natural resources. (auth)

6543 PULSED-CURRENT ORBITAL TUBE AND PIPE WELDING. Mulcahy, J. V. (Dimetrics, Inc., Hollywood, CA). Trans. Amer. Nucl. Soc.; 19: 122(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6544 STEELMAKING MOVES TO NUCLEAR ENERGY. O'Keefe, J. Can. Mach. Metalwork.; 85: No. 9, 64-65(Sep 1974).

A predicted world-wide shortage of coking coal by the end of this decade has boosted research into steelmaking with nuclear reactors. High temperature Reactors appear to be the most promising because of the high helium coolant exhaust temperatures (800 to 1000°C) which can be achieved. One study by the British Steel Corp. shows that fluid bed reduction coupled with existing high temperature reactors can produce steel at about $4 per ton cheaper than with the conventional blast furnace. (CAN)

6545 BORONIZING OF REFRACTORY METALS. I. Process Technology. Krzyminski, H. Haerterei-Tech. Mitt.; 28: No. 2, 100-105(Jun 1973). (In German).

Boronizing of Ti, Nb, Ta, Hf, and Zr was studied to produce hard, wear-resistant coatings. Amorphous B, ignited in vacuum, gave substantially perfect coatings at 900 to 1100°C, the thickness depending on the substrate, treatment time, and the degree of vacuum, e.g., Ti 5 h, 1000°C, 10^{-3} torr. (Metals Abstr.)

6546 BORONIZING OF REFRACTORY METALS. II. Constitution and Properties of Boride Films. Kunst, H. Haerterei-Tech. Mitt.; 28: No. 2, 105-109(Jun 1973). (In German).

Boronizing of Ti, Nb, Ta, Hf, Zr, and Ni was investigated. All boride films consisted of MeB_2 diborides, but that on Ti also contained the low-B TiB phase. Reasons for almost exclusive formation of diborides are discussed. The probable cause of this is a mechanism similar to that associated with Fe, i.e., favoring of B diffusion in a structurally determined preferred direction. The boride coatings are distinguished by high melting point hardness, and electrical and thermal conductivities, considerably higher than those of the substrates. Their corrosion and oxidation properties are discussed. The behavior of Ni was different in all respects from that of the refractory metals. (Metals Abstr.)

6547 . ELECTRON-BEAM WELDING OF METALS AND CERAMICS. Menesi, J. (Hiradastechnikai Ipari Kutato Intezet, Budapest). Finomech.-Mikrotech.; 12: 12-17(Jan 1973). (In Hungarian).

A review is presented of the literature concerning bondings between metals and ceramics. After briefly noting the disadvantages of conventional methods of bonding metals and ceramics—namely, mechanical bonding, soldering, and diffusion welding, a study is made of the technological parameters ensuring optimal bonding between ceramics and austenitic chromium–nickel steel, between ceramics and molybdenum, and between two ceramic materials by means of electron-beam welding. A series of tests on the effectiveness of electron-beam welding is described, which includes a wetting test (employing the stationary drop method), strength tests with a stationary drop sample, vacuum-tightness tests, heat-resistance tests, and metallographic and microhardness measurements. (IAA)

6548 AGE OF SCARCITY. The 11th Sir Julius Wernher Memorial Lecture of the Institution of Mining and Metallurgy. Cottrell, A. (Cambridge Univ., Eng.). Inst. Mining Met.; Trans./Sect. A; 83: 25-29(Jul 1974).

A part of the lecture deals very briefly with world requirements of energy. Consumption trends are discussed in the light of the two opposing factors: increase in needs and increasing

costs. The contribution that may be expected from nuclear energy is considered, and the availability and cost of uranium are discussed. (UK)

6549 NUCLEAR ENERGY FOR THE STEEL INDUSTRY. Finniston, H. M. Proc. Roy. Soc. (London), Ser. A; 340: No. 1621, 129-146(10 Sep 1974).

From 6th Royal Society Technology Lecture; London, Eng. (5 Dec 1973).

The steel industry, as a major consumer of coking coal and hydrocarbons, is exploring ways to reduce its dependence on these potentially expensive raw materials by making direct use of nuclear heat. Of the present two routes for producing steel, the major one (the hot metal route) employing the blast furnace which reduces iron ore to yield molten iron which is subsequently refined by basic oxygen steelmaking, does not lend itself to the application of nuclear heat; in the second (the cold metal route) recycled steel—or a substitute—is melted in an arc furnace where already today a proportion of the electricity used is generated in nuclear power stations. The development of direct reduction processes allows iron ore to be converted to a solid pre-reduced iron product. In the conventional pre-reduction process, fossil fuels are used as both fuel and as chemical reductant. With nuclear heat, the fossil fuel—reformed to a suitable reductant—is confined to the chemical role and not used as a source of heat. This reduction stage would be followed by arc melting, as in the present cold metal route. This basic process, which at present constitutes the minor route, could become the major one for the manufacture of steel in the long term. The various processes are discussed and a possible configuration for an eventual nuclear steelworks is outlined, together with some of the technical problems involved. (auth)

6550 FORMABILITY OF LOW-INTERSTITIAL 18 PCT Cr-2 PCT Mo FERRITIC STAINLESS STEEL. Davison, R. M. (Climax Molybdenum Co., Ann Arbor, MI). Met. Trans.; 5: No. 11, 2287-2294(Nov 1974).

From symposium on new developments in ferritic and duplex stainless steels; Cleveland, OH (19 Oct 1972).

Because of its excellent corrosion resistance, low-interstitial 18% Cr-2% Mo ferritic stainless steel is being considered for a wide range of applications, many of which involve the forming of sheet. An investigation was undertaken to examine the effects of rolling schedule on the formability of titanium-stabilized 18% Cr-2% Mo ferritic stainless steel sheet. Formability and texture development were evaluated by utilizing 1) plastic strain ratios and work-hardening exponents derived from tensile tests; 2) Swift and Olsen cup tests; and 3) x-ray pole figure analysis. Increasing the degree of cold reduction from 70 to 92% prior to the final recrystallization anneal led to substantial increases in deep drawability through changes in the recrystallization texture. Schedules of two-step cold rolling with an intervening recrystallization anneal, leading to increased total cold reduction, produced significantly higher plastic strain ratios than those produced by the one-step schedules. The crystallographic textures of the sheets were determined and correlated with the observed r values. (auth)

6551 UNCONVENTIONAL WELDING PROCESSES: A BIBLIOGRAPHY. Stemple, R. M. Oak Ridge, TN; Oak Ridge National Laboratory (1973). 65p. (ORNL-TM-4133).

The newer methods for welding have been termed "unconventional" to differentiate them from the older ones, and include electron beam, ultrasonic, laser beam and friction welding. The bibliography brings together the world literature on these processes through 1971. A separate section is devoted to each process, and the arrangement is by author with an introduction and key-word index. (Metals Abstr.)

6552 NEW PHENOMENON PRECEDING THE FIRST SINTERING STAGE OF METAL POWDERS. Behar, F. (CEN de Saclay, Gif-sur-Yvette, France); Servant, C.; Cizeron, G. Scr. Met.; 8: No. 11, 1331-1334(Nov 1974).

A distinct new stage 0 was resolved which precedes the normal state 1 in the sintering curves of Fe and Mo powders composed of smooth spherical particles. It can, therefore, be resolved only under the conditions of high speed dilatometry where the errors induced by the heating are minimized. No such phenomenon is observed in powders of irregularly shaped particles. The temperature and pressure dependence of stage 0 suggest that this kinetic regime is related to the relaxation of tangential interparticle stresses caused by incomplete compaction preceding stage 1 which is dominated by neck formation between particles under normal stresses. (auth)

6553 IMPROVED METALLOGRAPHY OF ZIRCONIUM ALLOYS. Kaufmann, P. D.; Danielson, P.; Baroch, E. F. (Teledyne Wah Chang Albany, OR). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 52-62(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Several procedures for the metallographic preparation and viewing of zirconium alloys have been developed in recent years which broaden the ability of the metallographer to more totally describe the morphology of these materials. For most detailed studies, it is not possible to describe with a single method the structure of commercial materials. Features found to be present by one technique may be completely missed or inconclusively revealed by other techniques. Anodizing a metallographically prepared sample of a zirconium alloy in a phosphoric acid solution results in color contrast between retained intermetallic compounds and the matrix. While this method is not new, its application to evaluation of low-solubility compounds is described. A color contrast is also observed between various types of intermetallic compounds by the nature of their different anodizing characteristics. A technique for metallographic preparation and anodizing is described. The resultant microstructure with typical carbide, phosphide, and silicide intermetallics in zirconium and zirconium alloys is shown with color photomicrographs. Characteristics of each of these three types of intermetallic compounds are described. A technique for heat tinting metallographic samples of Zircaloy-2 and Zircaloy-4 to show alloy microsegregation is also described. This method is complementary to anodizing and conventional etching methods. Subtle compositional variations, such as the tin distribution in the Zircaloys, can be revealed by heat tinting techniques. Such variations are not apparent with other techniques. (auth)

6554 HYDROGEN REDUCTION KINETICS OF MOLYBDATE WITH CALCIUM TUNGSTATE SOLID SOLUTIONS. Tkachenko, E. V.; Dobrovinskij, R. Yu.; Fetisov, V. B.; Yashchenko, V. L. (Ural'skij Gosudarstvennyj Univ., Sverdlovsk (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 11, 14-17(1973). (In Russian).

For English translation see the journal Stal USSR.

The kinetics of the reduction of solid solutions of molybdate and calcium tungstate with hydrogen were studied as a function of the temperature, pressure of the gaseous phase, and its rate of circulation in a closed or open space. It was established that during reduction of the solid solution $CaMo_xW_{1-x}O_4$ in a hydrogen flow of 3.6 to 7.2 l/hr for a period of 2 to 3 hrs at a temperature of 1000 to 1050°C all the Mo can be selectively released into the metallic phase. The basis for the pyrometallurgical separation of Mo and W from Mo scheelite concentrates under kinetic conditions was established. (tr-auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 7318, 7323, and 7780.

6555 (AD-778655) DEVELOPMENT, FABRICATION, AND TESTING OF HIGH STRENGTH DIRECTIONALLY SOLIDIFIED EUTECTIC ALLOYS. Final Report, March-December 1973. Kraft, E. H.; Thompson, E. R.; Patarini, V. M. (United Aircraft Corp., East Hartford, Conn. (USA). Research Labs.). Apr 1974. Contract N62269-73-C-0310. 80p. (UARL-N-911649-3). NTIS $4.00.

A directionally solidified eutectic alloy was synthesized based on the Ni-Cr eutectic, but containing in addition to nickel, 37.0 wt.% Cr, 18.0 wt.% W, 10.0 wt.% Co, and 0.1 wt.% Al. This eutectic, while not of optimized composition, shows superior oxidation-hot corrosion resistance over existing eutectic alloys and some nickel base superalloys, and as a system holds promise of a strength advantage over the superalloys in the temperature region of 2000 °F and above. Use of the Ni-3Nb reinforced eutectics has been made more practical by demonstration of superplastic bonding of a superalloy to the γ'-δ (Ni-23.1 Nb-4.4 Al) eutectic, such as would be done in forming a turbine blade root. The effect of particle impingement on this eutectic and the γ-γ'-δ (Ni-20.7 Nb-3.2 Al) eutectic was studied and showed that while some cracking can be expected with high impact energies, microstructural changes are limited to the immediate area of the impact. Heat treatment was shown to increase the room temperature and intermediate temperature strength of both δ reinforced eutectics, but has little effect at 2000°F. (auth)

6556 (COM-74-10831) METAL MATRIX COMPOSITES: A BIBLIOGRAPHY WITH ABSTRACTS. Report for 1971-March 1974. Lehmann, E. J. (National Technical Information Service, Springfield, Va. (USA)). Apr 1974. 121p. (NTIS-WIN-74-019). NTIS $20.00.

The bibliography contains 114 selected abstracts of research reports retrieved using the NTIS on-line search system-NTISEARCH. Reports concerning metal matrix composites in-

put into the NTIS collection over the last three years are included. Topics covered include mechanical properties, failure, fabrication, reinforcing materials, and applications. (auth)

6557 (COM-74-10854) BORON REINFORCED COMPOSITES. A Bibliography with Abstracts. Report for 1972–March 1974. Lehmann, E. J. (National Technical Information Service, Springfield, Va. (USA)). May 1974. 133p. (NTIS-WIN-74-022). NTIS $20.00.

The bibliography contains 128 selected abstracts of research reports retrieved using the NTIS on-line search system–NTISEARCH. The cited reports cover all uses of boron, especially boron fibers, as a reinforcing material in composites. The topics include fabrication, testing, uses, and structural and mechanical properties. (auth)

6558 (COM-74-50583) X-RAY PHOTOEMISSION STUDIES OF RARE EARTH HARD MAGNETS. Final Report. Cuthill, J. R.; McAlister, A. J.; Erickson, N. E.; Watson, R. E. (National Bureau of Standards, Washington, D. C. (USA)). 1974. 5p.

In the investigation the electronic properties of the RCo_5 compounds are studied by x-ray photoelectron spectroscopy studies of $SmCo_5$ and $PrCo_5$ and the results are related to the properties of the pure metals and to the picture developed in describing the magnetism of the compounds. The results indicate a valence band structure which is similar to that of Co metal; there is the suggestion that if there is charge flow it is off the rare-earth sites; there appears to be significant change in the 4F spectra from that of the pure rare-earth metals; and there is a suggestion of F-D hybridization. (GRA)

6559 (COO-2048-10) FUNDAMENTAL CONDITIONS FOR INITIATION OF INSTABILITIES IN DIRECTIONS OF PURE SHEAR, EFFECT OF STRENGTH LEVEL AND STRAIN RATE ON THE MODE OF FRACTURE INITIATION IN AISI 4340 STEEL, AND CHARACTERIZATION OF NOTCH DUCTILITY IN TYPES 304 AND 316 STAINLESS STEEL. Final Report. Chakrabarti, A. K.; McGarry, D. L.; Hauser, D.; Dalder, E. N. C.; Spretnak, J. W. (Ohio State Univ. Research Foundation, Columbus (USA)). 31 Mar 1973. Contract AT(11-1)-2048. 51p. Dep. NTIS $5.75.

This report is a final report on the various aspects of the second basic type of localization of plastic strain leading to fracture; namely, the localization of strain along characteristics as defined in continuum plasticity in the absence of a geometric instability or necking (the first mode of localization). The phases covered are (a) the effect of strength level and strain rate on the mode of initiation of fracture in AISI 4340 steel, (b) the conditions necessary for onset of localization of plastic flow along characteristics, (c) characterization of notch ductility of Type 316 stainless steel over a range of temperature and strain rates, and (d) characterization of notch ductility of Type 304 stainless steel base plate and weldments over a range of temperature and strain rates. (auth)

6560 (COO-3158-32) SPECIAL ASPECTS OF DIFFUSION IN THIN FILMS. Report No. 2287. Balluffi, R. W.; Blakely, J. M. (Cornell Univ., Ithaca, N. Y. (USA)). Aug 1974. Contract AT(30-1)-3504. 66p. Dep. NTIS $6.50.

Investigations conducted to identify and describe a number of factors which may cause diffusion in thin films to differ from the ordinary diffusion which occurs in bulk specimens at elevated temperatures are summarized. Diffusion in thin films may be expected to have special characteristics for a number of reasons. These factors are enumerated and discussed in turn with reference to experiment wherever possible. (auth)

6561 (ITF-74-80P) LESS MONOLAYER ADSORPTION ON CRYSTAL SURFACE. Lukiyanets, B. A.; Tovstyuk, K. D.; Stasyuk, I. V. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The quasiparticle spectrum using the Anderson model with adsorbate as impurity atoms and taking into account interelectronic mixing of adsorbed sites is considered. This problem is solved in cases of ferromagnetic and antiferromagnetic ordering of the adsorbed layer. It was found that both spectrum shift and damping as a result of the electronic interaction of the adsorbate-adsorbent system and band width are dependent on magnetic solution of the problem. (auth)

6562 (MIT-3342-3) LOW TEMPERATURE AND NEUTRON PHYSICS STUDIES. Progress Report, September 1973–August 1974. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics). 27 Aug 1974. Contract AT(11-1)-3342. 8p. (COO-3342-3). Dep. NTIS $4.00.

Experimental studies on the diamagnetic scattering of neutrons by bismuth and copper crystals were continued to determine the diamagnetization density distribution around atom centers and to search for oscillatory neutron scattering by Landau levels associated with the conduction electrons. Other studies include (a) nuclear spin state scattering amplitudes of ^7Li by polarized neutron scattering from nuclearly polarized crystals, (b) phase transformation and superconducting transition in ZrV_2, and (c) phonon instabilities associated with phase and superconducting transitions in the layered compounds 2H–$NbSe_2$ and 2H–$TaSe_2$. (auth)

6563 (NRL-7789) OBSERVATIONS ON USE OF THE J INTEGRAL TO DETERMINE PLANE-STRAIN FRACTURE TOUGHNESS FROM SUBSIZED SPECIMENS OF A TITANIUM 6Al–4V ALLOY. Yoder, G. R.; Griffis, C. A. (Naval Research Lab., Washington, D. C. (USA)). 3 Sep 1974. 20p.

J-integral procedures were used to obtain resistance curves of J versus crack extension from fatigue-precracked specimens of a titanium 6Al–4V alloy. Specimens of various geometries were employed, all in three-point bending. Crack extensions were delineated by heat tinting. The value of the J integral at the initiation of crack extension, J_{Ic}, was determined from the resistance curves and compared with a valid K_{Ic} value for this material. Comparison was made of the results obtained with the approximation equation $J = 2A/Bb$ to those obtained with the more cumbersome compliance technique in which analytical plane-stress solutions were used. The range of ratios of crack length to specimen width was examined over which $J = 2A/Bb$ holds, as was the decrease in crack extension at the experimental limit load with increase in ratio of specimen thickness to uncracked ligament. Variation in J_{Ic} from specimens cut from different positions through the plate thickness was also explored. (auth)

6564 (SAND-74-0157) PARAMETRIC STUDY OF DC DIODE SPUTTERED TUNGSTEN FILMS. Yost, F. G.; Sheldon, D. D.; Komarek, E. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1974. Contract AT(29-1)-789. 50p. Dep. NTIS $5.50.

A response surface experimental design technique was used to determine the properties of sputtered tungsten films as a function of sputtering parameters. This technique can be used to quickly and with relatively few experiments characterize the response of a given sputtering system to variations of sputtering parameters. Film thickness was found to be most sensitive to average sputtering power and argon pressure while resistivity was most sensitive to final substrate heater temperature. It is recommended that these correlations be monitored and utilized in production of sputtered tungsten film contacts. An interferometric technique was employed for film stress determination. Sputtering voltage approaching 4800 volts induces film de-adhesion and concomitant buckling due to large compressive stresses. By decreasing sputtering voltage or increasing argon pressure, it is possible to reduce film stress. The sputtering conditions described yield specimens having low stress. (auth)

6565 (UCSD-34P162-5) NEW MATERIALS BY LOW-TEMPERATURE CONDENSATION. Progress Report. Luo, H. L. (California Univ., La Jolla, San Diego (USA). Dept. of Applied Physics and Information Science). 1 Sep 1973. Contract AT(04-3)-34. 8p. Dep. NTIS $4.00.

Results of research programs on superconductivity, magnetic alloys, amorphous materials, and surface coating are presented. (JRD)

6566 (WAPD-TM-1028) MECHANICAL AND METALLURGICAL CHARACTERISTICS OF NiCrFe ALLOY 718 JOINTS BRAZED WITH Ni–13 w/o Cr–10 w/o P FILLER METAL. LWBR Development Program. Kaufman, S. F. (Bettis Atomic Power Lab., Pittsburgh, Pa. (USA)). Oct 1974. Contract AT(36-1)-GEN-14. 74p. Dep. NTIS $6.75.

Pin-hinge and lap-joint test specimens of NiCrFe alloy 718 sheet were prepared by brazing with BNi-7 brazing filler metal. Test variables included brazing temperature and time, rebrazing, test temperature, nickel plating, and joint clearance. Results of tensile and fatigue tests, conducted at room temperature and 600°F, are presented and discussed. The effects of the test variables on metallographic properties are also discussed. (auth)

6567 (WAPD-TM-1043) HIGH TEMPERATURE, TIME-DEPENDENT DEFORMATION IN INTERNALLY PRESSURIZED ZIRCALOY-4 TUBING (LWBR DEVELOPMENT PROGRAM). Busby, C. C.; Marsh, K. B. (Colorado Cooperative Wildlife Research Unit, Fort Collins (USA)). Oct 1974. Contract AT(36-1)-GEN-14. 24p. Dep. NTIS $4.25.

The plastic hoop strain in Zircaloy-4 tubing specimens internally pressurized at high temperatures to simulate short-time, high-temperature transients has been determined. These results are considered to be applicable also to irradiated rods since the initial high temperature transient would be expected to eliminate essentially all irradiation hardening. An equation relating plastic strain, temperature, hoop stress, and time is presented. (auth)

6568 (Y-DA-5317) HYDROGEN IN URANIUM ALLOYS. Powell, G. L.; Condon, J. B. (Oak Ridge Y-12 Plant, Tenn. (USA)). 21 Dec 1973. Contract W-7405-eng-26. 53p. (CONF-740205-13). Dep. NTIS $5.75.

From conference on physical metallurgy of uranium alloys; Vail, Colorado, USA (12 Feb 1974).

Hydrogen gas (or other hydrogen-containing species such as water) reacts with a uranium metal surface resulting in the dissolution of hydrogen in the uranium as interstitial atoms which are relatively mobile even at room temperature. Interstitial hydrogen atoms react with the uranium matrix to form uranium trihydride. This reaction, at equilibrium, limits the interstitial hydrogen concentration. Hydrogen activities present during annealing (usually traceable to moisture) can produce significant interstitial hydrogen concentrations. Upon cooling, the hydrogen precipitates as uranium trihydride. Single-phase uranium alloys containing niobium, titanium, and zirconium can have higher interstitial hydrogen solubilities and more stable hydride phases than unalloyed uranium. Uranium alloy-hydrogen relationships can be further complicated by the segregation of the alloy into two metal phases, each having a unique interstitial hydrogen solubility and hydride phase. Small additions of hydrogen to unalloyed uranium (0.1 wt ppM) markedly reduce the elongation and reduction in area in room temperature tensile tests while the yield strength remains unchanged. The addition of more hydrogen, up to 20 wt ppM, does not further reduce ductility. Low-alloy uranium behaves similarly. Gamma-stabilized uranium-8.5% niobium alloys require 10 wt ppM hydrogen to produce severe ductility losses and the tensile properties of gamma-stabilized uranium-7.5% niobium-2.5% zirconium alloy are only slightly effected by hydrogen below 70 wt ppM. (auth)

6569 SYNTHESIS OF Nb_3Ge BY rf SPUTTERING. Chencinski, N.; Cadieu, F. J. (Queens Coll., Flushing, NY). J. Low Temp. Phys.; 16: No. 5/6, 507-517(Sep 1974).

The conditions necessary for the formation of Nb_3Ge by low-pressure rf sputtering with a superconducting transition temperature $T_c > 21$ K have been investigated. Samples have been deposited onto cooled substrates so that the film is first amorphous and then is crystallized by a subsequent annealing, and onto hot substrates, in which case the film is crystalline upon deposition. The highest T_c samples were obtained for a substrate temperature of 735 ± 25°C. The optimum substrate temperature is the same as the optimum annealing temperature for crystallizing films which were first deposited onto cooled substrates. Special conditions are necessary for the formation of single-phase A15 samples of Nb_3Ge with an optimum T_c. The collisions that the sputtered atoms undergo with the sputtering gas molecules were used to thermalize the sputtered atoms. Here sputtering in both krypton and in argon is reported. (auth)

6570 SOLIDIFICATION MICROSTRUCTURE AND TEXTURE OF FUSION WELDED PLATINGS MADE OF CHROMIUM–NICKEL STEELS FOR NUCLEAR REACTOR COMPONENTS. Schmitt-Thomas, K. G.; Doffin, K. (Technische Univ. Muenchen (F.R. Germany). Inst. fuer Metallurgie und Metallkunde); Ruckdeschel, W. (Messer Griesheim G.m.b.H., Muenchen (F.R. Germany)). Werkstattstechnik; 26: No. 4, 50-54(1974). (In German).

9 figs.; 3 tabs.; 11 refs. Partly presented at the "reactor meeting of the Deutsche Atomforum" on Apr 12, 1973 in Karlsruhe.

Investigations were made on 18 different platings prepared by submerged arc welding with band electrodes made of X3 CrNiNb 24 12 or according to the plasma filament method with two "hot wires" of X2 CrNiNb 22 11. A report is given on the influence of the welding conditions on the crystallite inclination, the texture, and on relationships between anisotropy and material properties. (GE)

6571 EFFECT OF THE DEGREE OF DEFORMATION AND GRAIN SIZE ON THE TYPE OF NUCLEATION IN THE PRIMARY RECRYSTALLIZATION OF VANADIUM. Guttmann, V. (EURATOM, Petten, Netherlands). J. Less-Common Metals; 38: No. 2/3, 111-118(1974). (In German).

A study was made on the influence of the grain size and the degree of deformation on the site of nucleation of recrystallized grains in vanadium (99.96%). At high degrees of deformation, (>40%), the first grains are randomly distributed. At lower degrees of deformation, the grains are separated at grain boundaries, either by strain-induced boundary migration or by the normal nucleation mechanism at grain boundaries, the latter involving movement of the original grain boundary together with the low-angle boundary developed during annealing. A study of the structure, by electron transmission microscopy, shows that the results can be explained by the degree of development of low-angle boundaries. (auth)

6572 LANTHANUM–INDIUM SYSTEM. McMasters, O. D.; Gschneidner, K. A. Jr. (Ames Lab., IA). J. Less-Common Metals; 38: No. 2/3, 137-148(1974).

Differential thermal, x-ray diffraction, and metallographic methods were used to establish the lanthanum–indium phase diagram. Eutectic reactions occur at 742°C and 13.5 at.% In, at 1086°C and 54.0 at.% In, at 1120°C and 71.2 at.% In, and at 155°C and greater than 99.5 at.% In. A eutectoid reaction at 702°C and 8.1 at.% In develops as a result of indium additions for the 861°C γ-β transformation of lanthanum. The intermetallic compounds, La_3In, La_2In, and $LaIn_2$, decompose peritectically at 816, 955, and 1153°C, respectively. LaIn, La_3In_5, and $LaIn_3$ melt congruently at 1125, 1185, and 1140°C, respectively. Another compound is believed to exist in the temperature range 905 to 1073°C between 50 and 60 at.% In. Crystallographic data are given for most of these compounds. The maximum solid solubility of In in β-La is 3.5 at.% In and that in γ-La is 10.2 at.% In. Thermodynamic analyses of the La-rich end of the La–In system were made, and activities, activity coefficients, and partial molal free energies were derived for liquid lanthanum and γ-La. These data verify the close similarity of the La–In and Pr–Tl systems for the liquid ⇌ γ-La (or β-Pr) transformation. But they also show that there is a significant difference for the γ-La (or β-Pr) ⇌ β-La (or α-Pr) transformation which is not evident from a visual examination of the two diagrams. The existence of $LaIn_2$ with the $CeCu_2$-type structure is discussed in view of the present understanding of the occurrence of this structure type. (auth)

6573 THERMODYNAMIC PROPERTIES OF GOLD–VANADIUM ALLOYS. Eremenko, V. N.; Lukashenko, G. M.; Khmelenko, G. I. (Inst. of Problems in Materials Science, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. B; No. 9, 807-810(Sep 1974). (In Ukrainian).

The thermodynamic activities of components, Gibbs free energies, heats and entropies of formation of vanadium–gold solid solutions and compound V_3Au are determined by means of the emf measurements of concentration galvanic cells at temperatures of 600 to 740°C. (auth)

6574 ADSORPTION OF OXYGEN IN THE (100) FACE OF A TUNGSTEN SINGLE CRYSTAL. Ivanov, V. P.; Goldobin, A. N.; Kolomiichuk, V. N.; Savchenko, V. I. (Inst. of Catalysis, Novosibirsk, USSR). Sov. Phys.-Solid State (Engl. Transl.); 16: No. 2, 240-243(Aug 1974).

Translated from Fiz. Tverd. Tela; 16: No. 2, 367-371(Feb 1974).

The adsorption of oxygen on the (100) face of a tungsten single crystal has been studied by the diffraction of slow electrons. The sequence of surface structures correlates well with the change in work function during thermal desorption of the adsorbed oxygen. The reaction of the adsorbed oxygen with hydrogen of the gaseous phase (hydrogen pressure $>10^{-6}$ torr) takes place only on prolonged bombardment of the surface by an electron beam. (auth)

6575 VOLUME DIFFUSION AND DIFFUSION IN THE GRAIN BOUNDARIES OF ^{59}Fe AND ^{35}S IN MOLYBDENUM. Lesage, B.; Huntz, A. M. (Univ., Paris). J. Less-Common Metals; 38: No. 2/3, 149-165(1974). (In French).

The volume diffusion coefficients of iron-59 and sulfur-35 in molybdenum have been measured at temperatures between 900 and 1200°C. The abnormally low values of the pre-exponential factor D_0 and the activation energy Q_v are attributed to a diffusion mechanism along the dislocations which is predominant at the low temperatures under consideration. The intergranular diffusion coefficients have also been calculated for these radioactive tracers (^{59}Fe, ^{35}S) over the same temperature range (900 to 1200°C). The spread in the results obtained has been explained by the difference in the structure and the impurities present in these specimens. (auth)

6576 MASSIVE AND MARTENSITE TRANSFORMATIONS IN A Zr–1.25 WT. % Cr–0.1 WT. % Fe ALLOY. Rumball, W. M. (Royal Naval Engineering Coll., Plymouth, Eng.). J. Less-Common Metals; 38: No. 2/3, 233-237(1974).

Three microstructural features of a Zr–1.25 wt. % Cr–0.1 wt. % Fe alloy quenched from the β region have been observed. An initial transformation occurs at the β grain boundaries to a diffusional massive phase, α^*. This α^* phase is isomorphous with the cph α phase but is supersaturated with chromium and it also forms at equilibrium α/β interfaces during quenching from the $\alpha + \beta$ or $\alpha + \beta + ZrCr_2$ regions. Following the formation of α^* the remaining β phase transforms to either the highly-slipped massive α phase (often termed "Widmanstätten") at cooling rates below about 2000°C/s or to a twinned, martensitic α' phase at higher cooling rates. (auth)

6577 CRYSTAL STRUCTURE OF LANTHANUM–DYSPROSIUM ALLOYS. Krizek, H.; Taylor, K. N. R. (Durham Univ., Eng.). J. Less-Common Metals; 38: No. 2/3, 263-265(1974).

The lattice parameters of La–Dy alloys prepared by arc melting were measured. The structure of each alloy was examined

by x-ray diffraction from a rotating powder sample prepared using filings from an annealed ingot. Lattice parameter data are included and discussed. (JRD)

6578 MATERIAL CONSIDERATIONS. Hertzberg, R. W. (Lehigh Univ., Bethlehem, PA). Trans. Amer. Nucl. Soc.; 19: 119-120(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6579 TEMPERATURE-DEPENDENT INTERNAL FRICTION FOR URANIUM, U-0.78 WT. % Ti, U-6 WT. % Mo, AND U-10 WT. % Mo. Laats, E. T. (Idaho State Univ., Pocatello, ID); Schmidt, T. R.; Reuscher, J. A. Trans. Amer. Nucl. Soc.; 19: 130-131(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6580 EX-REACTOR BIAXIAL CREEP OF ZIRCALOY-4 CLADDING. Clevinger, G. S. (Babcock and Wilcox Co., Alliance, OH). Trans. Amer. Nucl. Soc.; 19: 143(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6581 CREEP COLLAPSE OF ZIRCALOY-4 CLADDING. Papazoglou, T. P. (Babcock and Wilcox Co., Alliance, OH). Trans. Amer. Nucl. Soc.; 19: 143-144(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6582 ANALYSIS OF FUEL CLADDING COLLAPSE DUE TO CREEP. Yoon, K. E.; Eckert, A. F. J. (Babcock and Wilcox Co., Alliance, OH). Trans. Amer. Nucl. Soc.; 19: 144-145(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6583 UNIAXIAL AND BIAXIAL MAXIMUM-UNIFORM-STRAIN PREDICTIONS FOR SLIGHTLY VARYING CROSS SECTIONS. Yang, P. Y. (Argonne National Lab., IL); Krieg, R. Trans. Amer. Nucl. Soc.; 19: 146-147(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6584 COBALT-CONTAINING HIGH-STRENGTH STEELS. A Critical Review of the Physical Metallurgy of Cobalt-Containing High-Strength Steels, and a Survey of Their Processing, Properties, and Uses. Magnee, A.; Drapier, J. M.; Coutsouradis, D.; Habraken, L.; Dumont, J. Cobalt Monograph Series. Brussels; Centre d'Information du Cobalt (1974). 128p.

Cobalt has been shown to play an important role in the three families of high-strength steels (carbide-strengthened, Ni-Co-Mo maraging, and stainless maraging). Very briefly, in addition to exerting a small solid-solution hardening effect, cobalt increases the M_s temperature; this factor has been used to advantage in counteracting the depressing effect of the other alloying elements present in these steels. Cobalt also refines the martensitic structure and leads to retention of the dislocation substructure at higher tempering temperatures, thereby giving rise to a finer precipitation of dislocation-nucleated carbides or intermetallic compounds. Finally, cobalt may affect the precipitation reactions themselves, e.g. by decreasing the solubility of molybdenum and chromium, and may induce ordering in the matrix. As a result of these effects, particularly the obtention of a fine dispersion of the strengthening phases, the steels under consideration exhibit attractive combinations of strength and toughness. (auth)

6585 PRESSURE DEPENDENCE OF THE DE HAAS-VAN ALPHEN EFFECTS IN YTTERBIUM. Slavin, A. J.; Datars, W. R. (McMaster Univ., Hamilton, Ont.). Can. J. Phys.; 52: No. 17, 1622-1627(1 Sep 1974).

The de Haas-van Alphen effect and the hcp-fcc phase transformation of ytterbium were studied using the magnetic field along the [0001] direction in the hcp phase and using pressures up to 4 kbar. Solid helium was used as the pressure medium. The pressure dependence of the three dHvA frequencies in the hcp phase for the [0001] magnetic field direction was linear within experimental error with $dF/dP = -1.2 \pm 0.2$ T/kbar for $F(P = 0)$ of 35.4 T, $dF/dP = 0.30 \pm 0.03$ T/kbar for $F(P = 0)$ of 142.5 T and $dF/dP = -0.78 \pm 0.10$ T/kbar for $F(P = 0)$ of 156.4 T. The dHvA amplitude in the hcp phase was independent of pressure up to the phase transition and no dHvA effect was observed in the fcc phase. The pressure of the phase transformation at 1.2°K was determined to be 2.15 ± 0.05 kbar. (auth)

6586 COERCIVE FORCE OF CAST AND SINTERED CONSTANT MAGNETS ON THE BASE OF ALLOYS OF THE SYSTEM Co-Cu-Fe-Ce. Arbuzov, M. P.; Pavlyukov, A. A.; Leskevich, L. I. (Inst. of Problems in Materials Science, Kiev). Porosh. Met., Akad. Nauk Ukr. SSR; No. 9, 48-50(Sep 1974). (In Russian).

Coercive forces of cast and sintered constant magnets of the Co-Cu-Fe-Ce system alloys are compared. Coercive force of the sintered magnets is shown to be lower than that of the cast magnets and to depend on size of the initial powder fractions. However their magnetic properties are high and comparable with those of constant magnets of the system Co-Pt. (auth)

6587 ADDITIONAL STUDY OF THE MOLYBDENUM-HAFNIUM SYSTEM. Eremenko, V. N.; Shabanova, S. V.; Velikanova, T. Ya.; Kocherzhinskii, Yu. A.; Pet'kov, V. V.; Shishkin, E. A. (Inst. of Material Behavior Problems, Kiev). Metallofizika; No. 52, 94-98(1974). (In Russian).

By methods of high-temperature, differential thermal analysis with x-ray and metallographic study of alloys a eutectic type of crystallization $L \rightleftharpoons (HfMo_2) + (\beta\text{-Hf})$ was confirmed. The eutectic composition is at 50 at.% Hf (in contrast to literature data of 41 and 57 at.% Hf). A careful study of alloys in the $HfMo_2$ region showed that at temperatures from 500 to 1400°C the Laves phase has a cubic structure of the type $MgCu_2$. (SJR)

6588 CRYSTAL CHEMISTRY OF LAVES PHASES IN THE HAFNIUM-VANADIUM-CHROMIUM SYSTEM. Minaeva, S. A.; Budberg, P. B.; Shishkin, E. A. (Inst. of Metal Physics, Kiev). Metallofizika; No. 52, 98-101(1974). (In Russian).

By the methods of microstructural, x-ray, and differential thermal analyses a study was made of the crystal structure of HfV_2 and $HfCr_2$ compounds, and it was established that there is a succession of polymorphic modifications with temperature. The HfV_2 compound forms from a melt at 1550°C and had a single modification - a structure of the type $MgCu_2$. The polythermal section between the $HfCr_2$ and HfV_2 compounds is constructed. The section is not quasibinary. (SJR)

6589 MUTUAL SOLUBILITY OF BINARY LAVES PHASES OF YTTRIUM AND PRAESEODYMIUM WITH METALS OF THE IRON TRIAD. Kharchenko, O. I.; Koshel, O. S.; Bodak, O. I. (Lvov State Univ.). Metallofizika; No. 52, 101-102(1974). (In Russian).

Literature data on the binary systems (Y,Pr)-(Fe,Co,Ni) are presented. These systems with the exception of the Pr-Fe system are characterized by the formation of a Laves phase with a structure of the type $MgCu_2$ (λ_2) at a 33.3 at.% rare earth metal content. Continuous series of solid solutions were found in the systems $Y(Co,Ni)_2$, $(Y,Pr)Co_2$, and $(Y,Pr)Ni_2$. The lattice constants of the solid solutions $(Y,Pr)Co_2$ and $(Y,Pr)Ni_2$ changed in correspondence with Vegard's rule. An insignificant negative deviation from linearity was observed for the continuous solid solution $Y(Co,Ni)_2$. There is no continuous transition between the binary compounds YNi_2 and YFe_2; these alloys are heterogeneous in this region. The solubility of praeseodymium in the YFe_2 compound is on the order of 3 at.% Pr. (SJR)

6590 PHYSICAL-CHEMICAL STUDY OF THE INTERACTIONS OF LAVES PHASES IN THE ZIRCONIUM-RUTHENIUM-ALUMINUM AND THE HAFNIUM-RUTHENIUM-ALUMINUM SYSTEMS. Spitsyna, T. A.; Markiv, V. Ya.; Raevskaya, M. V.; Sokolovskaya, E. M.; Zubchenko, V. S. (Moscow State Univ.). Metallofizika; No. 52, 103-105(1974). (In Russian).

As a result of a physical chemical study of the effect of ruthenium on aluminum alloys containing zirconium and hafnium, significant regions of homogeneity of solid solutions were found on the basis of the compounds $ZrAl_2$ and $HfAl_2$. The solubility of ruthenium in $ZrAl_2$ is 27 at.% and in $HfAl_2$ it is 23 at.%. (SJR)

6591 TERNARY LAVES PHASES IN THE SCANDIUM-RUTHENIUM-ALUMINUM AND THE YTTRIUM-RUTHENIUM-ALUMINUM SYSTEMS. Karatygina, E. P.; Burnashova, V. V.; Raevskaya, M. V.; Sokolovskaya, E. M. (Moscow State Univ.). Metallofizika; No. 52, 105-109(1974). (In Russian).

By the methods of x-ray structural and microstructural analyses a study was made of the systems (Sc,Y)-Ru-Al along the cuts 33.3 at.% Sc and Y. In the Sc-Ru-Al system a ternary Laves phase was found with a structure of the type $MgZn_2$ and lattice constants $a = 5.278$ Å, $c = 8.571$ Å and $c/a = 1.624$ (for the composition $Sc_{33}R_{17}Al_{50}$). Six ternary compounds were found in the YRu_2-YAl_2 section. Their crystal structures were not established. (SJR)

6592 INTERACTION OF LAVES PHASES IN Y-Ru-(Fe, Co, Ni) SYSTEMS. Tolkunova, E. F.; Burnashova, V. V.; Raevskaya, M. V.; Sokolovskaya, E. M. (Moscow State Univ.). Metallofizika; No. 52, 109-111(1974). (In Russian).

By methods of x-ray structural and microstructural analyses a study was made of alloys in the Y-Ru-(Fe,Co,Ni) systems along the 33.3 at.% Y section at 600°C. Significant solubility of the third component in the binary compound was found. The compounds YFe_2, YCo_2, and YNi_2 dissolve up to 45, 50, and 53 at.% Ru. The compound YRu_2 dissolves up to 10 at.% of the third component. (SJR)

6593 LAVES PHASES AND THEIR PROPERTIES IN THE RUTHENIUM–VANADIUM–ZIRCONIUM AND THE RUTHENIUM–VANADIUM–HAFNIUM SYSTEMS. Akhverdyan, M. M.; Burnashova, V. V.; Gladyshevskii, E. I.; Raevskaya, M. V.; Sokolovskaya, E. M. (Moscow State Univ.). Metallofizika; No. 52, 111-112 (1974). (In Russian).

By using physical chemical methods of analyses in the Ru–V–Zr and Ru–V–Hf systems at ruthenium contents from 15 to 23 and from 8 to 19 at.% respectively, new ternary Laves phases were found for the first time having a structural type of $MgZn_2$. The superconducting and magnetic properties of the binary and ternary Laves phases were investigated. (SJR)

6594 LAVES PHASES IN BINARY ALLOYS OF ZIRCONIUM WITH GROUP VIII METALS OF THE PERIODIC TABLE. Eremenko, V. N.; Semenova, E. L.; Shtepa, T. D. (Inst. of Material Behavior Problems, Kiev). Metallofizika; No. 52, 112-116(1974). (In Russian).

Phase equilibria were investigated in binary alloys of zirconium containing osmium, rhodium, and iridium in the region of 0 to 50 at.% Zr. The existence of Laves phase was established in systems containing osmium and iridium. The Laves phases had structures of the type $MgZn_2$ (a = 5.20 Å, c = 8.53 Å) and $MgCu_2$ (a = 7.36 Å) respectively. The temperatures, modes of formation, and regions of homogeneity were established. The appearance of Laves phase was considered in binary alloys of zirconium with metals of Group VIII as a function of the position of the B-component in the Periodic Table. (SJR)

6595 INTERACTION OF LAVES PHASES IN THE V–W–Zr TERNARY SYSTEM. Eremenko, V. N.; Sukhaya, S. A.; Tret'yachenko, L. A. (Inst. of Material Behavior Problems, Kiev). Metallofizika; No. 52, 116-119(1974). (In Russian).

By the methods of metallographic and x ray analyses and by determining the initial melting temperature of the V–W–Zr ternary system along cross-sections at 50 and 33.3 at.% Zr in the cast state and annealed at 1150°C for 200 h it is shown that between the Laves phases ZrV_2 and ZrW_2 a continuous series of solid solutions is formed with a structure of the type $MgCu_2$ (λ_2). (SJR)

6596 SOLUBILITY OF MANGANESE AND CHROMIUM IN THE LAVES PHASES $CeFe_2$, $CeCo_2$, AND $CeNi_2$. Kalychak, Ya. M.; Bodak, O. I. (Lvov State Univ.). Metallofizika; No. 52, 119-121 (1974). (In Russian).

A determination was made of the existence regions of solid solutions of manganese and chromium in binary compounds of cerium with metals of the iron family having a structure of the type $MgCu_2$. The compound $CeFe_2$ dissolves 32 at.% Mn; the compound $CeCo_2$ dissolves 10 at.% Mn and 8 at.% Cr, and the compound $CeNi_2$ dissolves 5 at.% Mn and 7 at.% Cr. Replacement of iron by chromium in $CeFe_2$ hardly changes its lattice constants. Hence it was not possible to establish the limits of chromium solubility. (SJR)

6597 LIQUIDUS DIAGRAM OF THE LANTHANUM–IRIDIUM SYSTEM. Dmitrieva, V. N.; Vorob'ev, V. D.; Varekha, L. M.; Domashev, V. F.; Gusynin, B. A. Metallofizika; No. 52, 121-123 (1974). (In Russian).

By methods of x-ray phase, microstructural, and differential analyses a study was made of the La–Ir system. A total of 10 intermetallic compounds were found in the system: La_4Ir, La_3Ir, La_7Ir_3, La_3Ir_2, $LaIr$, $LaIr_2$, $LaIr_3$, La_3Ir_7, $LaIr_5$, and a phase whose composition is probably La_3Ir_{17}. A determination was made of the melting temperature of all intermetallic compounds (except La_2Ir_{17}) and of the lattice parameters of $LaIr_3$, La_2Ir_7, and $LaIr_5$. (SJR)

6598 X-RAY STUDY OF LAVES PHASES IN THE (Zr,Hf)–Mo SYSTEMS. Nemoshkalenko, V. V.; Ostafiichuk, B. K.; Nesenyuk, A. P.; Krivitskii, V. P.; Pet'kov, V. V.; Nikolaeva, L. I.; Shpak, A. P.; Mindlina, M. A. (Inst. of Metal Physics, Kiev). Metallofizika; No. 52, 127-131(1974). (In Russian).

Conditions are given for the formation and production of Laves phases of $ZrMo_2$ with a structure of $MgCu_2$ (λ_2-phase) and of $HfMo_2$ with structures of MgCu (λ_2-phase) and $MgNi_2$ (λ_3-phase). The $L\beta_2$ and $M_{IV,V}$-emission bands of molybdenum in the $ZrMo_2$ and $HfMo_2$ compounds were obtained. Measurements were taken on relative integral and peak intensities, widths, and displacements of these bands. (SJR)

6599 STUDY OF PHASE EQUILIBRIA IN REFRACTORY METAL ALLOYS. Svechnikov, V. N.; Kocherzhinkii, Yu. A.; Kobzenko, G. F.; Pan, V. M.; Shurin, A. K. (Inst. of Metal Physics, Kiev). Metallofizika; No. 52, 3-22(1974). (In Russian).

Consideration is given to structural features of binary diagrams of chromium with group IV–VI refractory metals and with rare earths, of silicon with group IV–VI refractory metals, of hafnium with group IV–VIII transition metals, of group IV–VIII transition metals with refractory replacement phases and others. 10 fig. 116 references. 2 tables. (SJR)

6600 REGULARITIES IN THE FORMATION OF LAVES PHASES. Grigorovich, V. K. (Inst. of Metallurgy, Moscow). Metallofizika; No. 52, 43-50(1974). (In Russian).

A comparison is made of the morphotrophy and polymorphism of diamond-like compounds, pure metals, and Laves phases. Possible reasons of structural transitions are analyzed in relation to the electronic structure under the action of temperature, pressure, composition, and change of element position in the Periodic Table. 3 fig. (SJR)

6601 EFFECT OF ELECTRON CONCENTRATION ON THE FORMATION AND STRUCTURE OF LAVES PHASES IN A NUMBER OF TRANSITION METAL SYSTEMS. Varli, K. V.; D'yakonova, N. P.; Rivlin, A. M.; Shakov, Yu. A.; Umanskii, Ya. S. (Moscow Inst. of Steel and Alloys). Metallofizika; No. 52, 61-64(1974). (In Russian).

A study was made of the effect of electron concentration on the formation of Fe_2W and Co_2Nb Laves phases in the ternary systems iron–tungsten–niobium, iron–tungsten–nickel and cobalt–niobium–tungsten. It was established that a decrease in electron concentration with replacement of tungsten by niobium stabilizes the Fe_2 (W,Nb) Laves phase. An anomalous change in lattice constants of the Fe_2W phase on alloying with nickel, and a change in lattice constant and phase structure of Co_2Nb on alloying with nickel are associated with a change in electron concentration. (SJR)

6602 POLYMORPHISM OF LAVES PHASES IN THE ZIRCONIUM–CHROMIUM SYSTEM AND ITS REFLECTION IN X RAY EMISSION SPECTRA. Nemoshkalenko, V. V.; Nesenyuk, A. P.; Krivitskii, V. P.; Pet'kov, V. V.; Nikolaev, L. I.; Polenur, A. V.; Mamko, B. P.; Shpak, A. P.; Mindlina, M. A.; Ostafiichuk, B. K. (Inst. of Metal Physics, Kiev). Metallofizika; No. 54-58 (1974). (In Russian).

X-ray data are presented on studying the Laves phases of three types λ_1, λ_2 and λ_3 of the $ZrCr_2$ compound. X-ray emission bands of both components were obtained with each of the compound components being investigated according to two x-ray series: zirconium from the L and M, and chromium from the K and L series. As a result of the superposition of the x-ray emission bands of different series of the same component in a single energy scale, conclusions are reached on electronic structure changes of zirconium and chromium taking place as a result of the formation of various Laves phases of the same $ZrCr_2$ compound by these components. (SJR)

6603 MAGNETIC PROPERTIES OF LAVES PHASES IN THE SYSTEM ZIRCONIUM–(IRON, COBALT)–ALUMINUM. Kuz'menko, P. P.; Suprunenko, P. A.; Markiv, V. Ya.; Butsik, T. M. (Kiev State Univ.). Metallofizika; No. 52, 58-61(1974). (In Russian).

Results are presented of a study of the magnetic susceptibility and ferromagnetic transition temperatures of Laves phases with structures of the type $MgCu_2$ and $MgZn_2$ in the $ZrFe_2$–$ZrAl_2$ and $ZrCo_2$–$ZrAl_2$ systems, on the basis of which a determination was made of the magnetic moments of the 3d-metal ions, their valencies and electron concentrations in the homogeneity regions of the phases under study. (SJR)

6604 X-RAY IDENTIFICATION OF PHASES WITH STRUCTURES OF THE TYPE $MgZn_2$ AND $MgNi_2$. Pet'kov, V. V. (Inst. of Metal Physics, Kiev). Metallofizika; No. 52, 64-70 (1974). (In Russian).

A discussion is presented of factors having an effect on the quality of Roentgenograms of Laves phases with structures of $MgZn_2$ and $MgNi_2$. Recommendations are given on the use of x-ray tubes of native origin for x-ray identification of these phases, and also concrete examples for detecting new λ_3 - phases are presented. (SJR)

6605 INTERACTION OF LAVES PHASES IN THE SYSTEMS $ZrMn_2$–$ZrCr_2$ AND $ZrMn_2$–ZrV_2. Prima, S. B.; Tret'yachenko, L. A.; Pet'kov, V. V. (Inst. of Material Behavior Problems, Kiev). Metallofizika; No. 52, 75-80(1974). (In Russian).

By the methods of metallographic, x-ray, and thermographic analyses a study was made of cast and annealed alloys of the $ZrMn_2$–$ZrCr_2$ and $ZrMn_2$–ZrV_2 systems. Phase diagrams of these systems were constructed. It was established that in these systems, along with Laves phases having structures of the type $MgCu_2$ (λ_2) and $MgZn_2$ (λ_1), a Laves phase with a structure of the type $MgNi_2$ (λ_3) forms. (SJR)

6606 THERMODYNAMIC PROPERTIES OF LIQUID ALLOYS OF THORIUM WITH ALUMINUM. Poyarkov, A. M.; Lebedev, V. A.; Nichkov, I. F.; Raspopin, S. P. Sov. At. Energy (Engl. Transl.); 35: No. 6, 1138-1140(Dec 1973).

Translated from At. Energ. (USSR); 35: No. 6, 434-435(Dec 1973).

The thermodynamic properties of saturated solutions of thorium in aluminum, and the compound $ThAl_3$ at equilibrium with them, were measured by analysis of the emf of the galvanic cell: $Th_{sol}|KCl-NaCl + ThCl_n||KCl-NaCl + ThCl_4|Th-Al_{liq}$. The alloys were prepared by fusion of shavings of metallic thorium (99.8%) with aluminum (99.97%) in crucibles of beryllium oxide, directly in the cell. (SFL)

6607 APPLICATION OF ACOUSTIC EMISSION TECHNIQUES TO EVALUATING DEGREES OF EMBRITTLEMENT IN STEEL. Nakasa, H.; Tomoda, Y.; Takaku, H. (Central Research Inst. of Electric Power Industry, Tokyo). Denryoku Chuo Kenkyusho Gijutsu Kenkyusho Hokoku; No. 73027, vp(Oct 1973). (In Japanese).

For the purpose of evaluating degrees of neutron-irradiation embrittlement as part of reactor vessel surveillance, acoustic emission (AE) characteristics in tensile tests have been investigated for several metal specimens degraded by neutron irradiation and for mild-steel specimens degraded by strain aging. The linear relationship between the logarithms of the AE amplitude, a, and the number of emissions, n(a), [i.e., $\log n(a) = -m \log a + \log n_0$] holds in the metal specimen as well as in the rock specimen and earthquakes. The change of the slope, m, is very sensitive to degrees of embrittlement, and the AE non-dimensional parameter can be an indicator to estimate the degree of material degradation. As the m-value can be obtained easily from the relationship between the AE amplitude and the number of emissions near the yield stress in the tensile test, AE techniques utilizing the m-value are applicable to diagnostics for irradiation embrittlement in reactor vessel surveillance. (JA)

6608 STRUCTURAL AND MAGNETIC PROPERTIES OF PSEUDOBINARY SYSTEM $Zr_{1-x}Mo_xFe_2$. Itoh, K.; Fujita, Y.; Kanematsu, K. (Nihon Univ., Funabashi, Japan). J. Phys. Soc. Jap.; 36: No. 4, 1024-1028(Apr 1974).

Crystallographic, magnetic, and Mössbauer studies on $Zr_{1-x}Mo_xFe_2$ are reported. Crystal structure changes with increasing x from $MgCu_2$ type ($x \leq 0.15$) to $MgZn_2$ type ($x \geq 0.25$). Magnetic moment of Fe estimated from magnetization is nearly unchanged ($\approx 1.6\ \mu_B$) in $x \leq 0.15$ and decreases considerably in $x \geq 0.2$. Mössbauer spectra at 78°K showed the existence of Fe with hyperfine fields of 217 and 199 kOe in $Zr_{0.9}Mo_{0.1}Fe_2$ and of Fe with 99 and 0 kOe in $Zr_{0.75}Mo_{0.25}Fe_2$. Magnetic properties of $MgZn_2$ type compounds $Zr_{0.7}Mo_{0.3}Fe_y$ and $Zr_{0.5}Mo_{0.5}Fe_y$ change from weak ferromagnetism for $y = 2.0$ to paramagnetism for $y = 1.6$. (JA)

6609 LATEST PROGRESS AND APPLICATION OF SUPERCONDUCTIVE MATERIALS. Tachikawa, K. (National Research Inst. for Metals, Tokyo). Nippon Kinzoku Gakkai Kaiho; 12: No. 12, 853-859(Dec 1973). (In Japanese).

The subjects reviewed include the application of superconduction, the development of ultrafine, multicore, superconductive wires, the development of intermetallic compound materials, and research on new superconductive materials. In the application of superconduction, the magnetic field at the energizing speed of 70 kOe/s was produced with success and promise, using an ultrafine, multicore, woven wire material. A large capacity superconductive generator of 1,000 MW class will perhaps be produced in 1980s. Magnetic floating train has experimentally succeeded in Japan. Power transmission is expected to have capacity of 5 GW in 1990. Further, the superconducting quantum interference detector may be used as the standard of potential instead of standard cells. The development of a highly stable, ultrafine, multicore wire material enabled to use superconductor safely. Particularly, the magnet for synchrotron orbit may hopefully use superconductor in future. As for the intermetallic compounds, the research on beta-W type compounds, NaCl type compounds, and Laves type compounds is summarized. In conclusion, the new manufacturing processes, for example ion plating method having high speed of vapor deposition, have to be developed in order to make the wires of compounds having better characteristics. (JA)

6610 EFFECT OF BRITTLE INTERFACIAL COMPOUNDS ON DEFORMATION AND FRACTURE OF MOLYBDENUM/ALUMINUM FIBRE COMPOSITES. Heitman, P. W.; Shepard, L. A.; Courtney, T. H. J. Mech. Phys. Solids; 21: No. 2, 75-89 (Mar 1973).

The effect of brittle intermetallic compounds at the fiber-matrix interface on the deformation and fracture characteristics was investigated for an Al matrix and Mo filament. Three series of composites, containing Mo 25, 34, and 53% by volume were studied at room temperature and 78°K as a function of volume fraction of intermetallic compound formed at the interface. The reaction product consisted of a lesser phase $Al_{12}Mo$ and a major phase Al_5Mo. For ductile filaments the composite strength degradation was relatively minor and composite strength could be predicted by a modified mixture rule. For notch-sensitive filaments, severe filament degradation occurred on compound formation, due to cracks formed during deformation at the roots of compound nodules. The presence of 10% compound by volume resulted in 50% decrease in tensile strength, but larger amounts of compound caused little additional strength reduction. At filament volume fractions ≤34% and compound volume fractions <10%, composite fracture occurred by statistical accumulation of individual fiber breaks, but at higher fiber or compound volume fractions, composite failure occurred on the first or second filament failure. (Metals Abstr)

6611 OBTAINING FINE-GRAIN BERYLLIUM AND ITS PROPERTIES. Papirov, I. I.; Taranenko, I. A.; Tikhinskii, G. F. At. Energ. (USSR); 37: No. 3, 220-222(Sep 1974). (In Russian).

By means of three consecutive cycles of extrusion and precipitation of 99.9%-pure beryllium lithide during gradual reduction of deformation temperatures, polycrystallic beryllium of mean grain size d = 5 microns was obtained. The texture and mechanical properties of such a metal under tension were studied. At 20°C, the tensile strength was equal to 45 kg/mm², relative elongation −17.5% and constriction −10.5%. The temperature threshold of cold brittleness was Tx = 150°C. An estimation of the limiting possible reduction of the quantity Tx in metal of isotropic structure by fragmenting the grain yields: for $d \to 0$, $Tx \to 100$°C. (tr-auth)

6612 CRYSTAL-FIELD ANISOTROPY OF Sm^{3+} IN $SmCo_5$. Buschow, K. H. J.; Van Diepen, A. M.; De Wijn, H. W. (Philips Gloeilampenfabrieken N. V., Eindhoven, Netherlands). Solid State Commun.; 15: No. 5, 903-906(1 Sep 1974).

It is shown that the major contribution to the high uniaxial magnetocrystalline anisotropy of the compound $SmCo_5$ arises from the action of crystalline and exchange fields on the Sm^{3+} ion. (auth)

6613 HIGH FIELD MAGNETIZATION OF $NdAl_2$ SINGLE CRYSTALS INTERPRETED WITH CRYSTAL FIELD THEORY. Cock, G. J.; Roeland, L. W.; Purwins, H. G.; Walker, E.; Furrer, A. (Univ., Amsterdam). Solid State Commun.; 15: No. 5, 845-847(1 Sep 1974).

The magnetization of $NdAl_2$ single crystals was measured at 4.2, 20.3, and 77 K in magnetic fields up to 35 tesla applied in the ⟨100⟩, ⟨110⟩ and ⟨111⟩ directions. The magnetization in these directions may be described theoretically, without any fitting, in terms of two cubic crystalline electric field parameters and one molecular field constant which have been taken from inelastic neutron scattering data. (auth)

6614 CONCERNING ANOTHER INDICATED PHASE TRANSFORMATION IN YTTERBIUM. Beaudry, B. J.; Gschneidner, K. A. (Ames Lab., Iowa). Solid State Commun.; 15: No. 5, 791-793 (1 Sep 1974).

Experimental data are presented which show the new phase transformation in ytterbium reported by Hurd and Alderson (Solid State Commun.; 12: 375 (1973)) is probably due to hydrogen contamination in their "high purity" ytterbium. (auth)

6615 SUPERCONDUCTIVITY AND STABILITY OF NEAR EQUIATOMIC V-Ru COMPOUNDS AT HIGH PRESSURE. Smith, T. F.; Shelton, R. N.; Lawson, A. C.; Chu, C. W. (Univ. of California, San Diego, La Jolla). J. Phys., F (London); 4: No. 9, 1423-1432(Sep 1974).

The variation of T_c for the V-Ru compounds over the composition range 42 to 47.5 at% Ru was investigated for hydrostatic pressures up to 25 kbar. At zero pressure T_c peaks sharply between 45.5 and 46 at% Ru, with a subsidiary peak occurring about 44 at%. Heat treatment significantly influences the value of T_c. For the cubic, B2 structure compounds with less than 45 at% Ru, T_c follows a slight linear decrease under pressure. At Ru concentrations greater than 45.5 at%, for which the crystal structure undergoes a tetragonal distortion at zero pressure, there is a dramatic change in the pressure dependence of T_c, which becomes strongly positive. This behavior is discussed in relation to the pressure induced stability of the cubic structure. (auth)

6616 MAGNETIC PROPERTIES AND ELECTRONIC STRUCTURE OF RARE EARTH-TRANSITION METAL INTERMETALLIC COMPOUNDS. Gomes, A. A.; Guimaraes, A. P. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). J. Phys., F (London); 4: No. 9, 1454-1465(Sep 1974).

A model for the electronic structure of the R_xM_y intermetallic compounds is proposed in which the s electrons are spread over the crystal and the d states are mostly localized on the transition metal sites, the degree of localization varying from 3d to 4d and 5d. Two cases are distinguished: (1) magnetism driven by the

localized f moments (eg. $GdCo_2$), and (2) magnetism sustained by the d band (eg. $LuFe_2$). These two situations are discussed in terms of an effective s-d coupling and an s-f exchange; the transition metal magnetic moment in (2) is calculated using a simple model. The rare earth isomer shifts and the paramagnetic susceptibility of the compounds are also considered; the excess hf fields in the RFe_2 compounds may be understood within this picture. Finally, it is shown that the s-d hybridization mechanism may account for the observed effective s-d coupling. (auth)

6617 MAGNETIC PROPERTIES OF NdZn. Buschow, K. H. J.; van Laar, B.; Elemans, J. B. A. A. (Philips Gloeilampenfabrieken N. V., Eindhoven, Netherlands). J. Phys., F (London); 4: No. 9, 1517-1521(Sep 1974).

The magnetic properties of the compound NdZn were studied by neutron diffraction and magnetic measurements. The compound NdZn has the cubic CsCl structure with a = 3.666 ± 0.001 Å. The paramagnetic Curie temperature is θ_p = 30K. A paramagnetic-antiferromagnetic transition occurs at T_N = 66 K. At 4.2 K NdZn has an antiferromagnetic structure with ferromagnetic planes parallel to (100) in which the moment directions are perpendicular to these planes and alternate with those in neighboring planes. The moment of the Nd atoms is strongly reduced (2.52μ_B). The magnetic properties of the compound NdZn sharply constrast with the properties of the heavy rare earth counterparts of the same crystal structure. Implications of the experimental data on the validity of the RKKY approach are discussed. (auth)

6618 ELECTRICAL RESISTIVITY OF SOLUTIONS OF GERMANIUM, TIN, AND LEAD IN LIQUID SODIUM. Hubberstey, P.; Pulham, R. J. (Nottingham Univ., Eng.). J. Chem. Soc., Faraday Trans., I; 70: No. 9, 1631-1635(1974).

The electrical resistivity of solutions of germanium (up to 1.0 atom %), tin (up to 6.9 atom %) and lead (up to 7.8 atom %) in liquid sodium were measured over the temperature ranges 200 to 450, 200 to 400, and 100 to 300°C respectively. A capillary technique was used which involved circulation of the liquid metal through the capillary by use of an electromagnetic pump. For tin and lead, a plot of resistivity (ρ) against concentration (c) is nearly linear with an increasingly positive $d\rho/dc$. For germanium, $d\rho/dc$, although positive, decreases slightly. All three solutes, especially tin, increase the resistance of sodium by a relatively large amount. The resistivity of the solutions increases with increasing temperature much as does that of pure sodium. Dilute solutions containing both germanium and tin in liquid sodium show additive behaviour compatible with lack of association between the two solutes. (auth)

6619 d RESONANCE EFFECTS ASSOCIATED WITH RARE EARTHS AND DILUTE RARE EARTH ALLOYS. Devine, R. (Univ., Montreal). J. Phys., F (London); 4: No. 9, 1447-1453(Sep 1974).

A simple model wavefunction is used for pure rare earths and rare earths in Au and Ag to obtain information on 5d virtual bound states. It is shown that the bound state character deduced can account for the excess moments in pure earths and, together with other scattering terms, explains the resistivity increases found in Ag and Au due to rare earth impurities. The excess moments and variation in the Knight shift of Au and Ag for rare earth-Au or Ag alloys are also calculated. (auth)

6620 SELF-DIFFUSION UNDER PRESSURE IN DELTA CERIUM. Languille, A.; Calais, D.; Fromont, M. (CEN, Fontenay-aux-Roses, France). J. Phys. Chem. Solids; 35: No. 10, 1373-1379(Oct 1974). (In French).

After the study of self-diffusion in δ cerium under atmospheric pressure in which a mechanism of activated interstitials was assumed (a mechanism which implies a negative activation volume), it was logical to confirm this hypothesis by studying self-diffusion under higher pressures. As expected, the coefficient of self-diffusion was found to rise with pressure, the activation volume remaining negative throughout: $\Delta V < -2 cm^3/mol$ or -10% mol vol. (auth)

6621 SELF-DIFFUSION IN α-HCP AND γ-BCC YTTERBIUM. Fromont, M.; Languille, A.; Calais, D. (CEN, Fontenay-aux-Roses, France). J. Phys. Chem. Solids; 35: No. 10, 1367-1371 (Oct 1974). (In French).

The grinding method has been used to study self-diffusion in ytterbium metal. The diffusion is certainly produced by a vacancy mechanism in the h.c.p. structure (the Van Liempt correlation is fairly well followed), although the frequency factor is lower. The high diffusivities and low activation energy in the b.c.c. phase are characteristic of diffusion behavior in anomalous b.c.c. metals, and consistent with the activated interstitial model. (UK)

6622 ENHANCEMENT OF KONDO SCATTERING FROM Yb IN Ag–Pd MATRIX. Murani, A. P. (Imperial Coll. of Science and Tech., London). Solid State Commun.; 15: No. 6, 987-990(15 Sep 1974).

The Kondo-slope in the low temperature electrical resistivity of Yb in Ag is observed to increase significantly with additions of small amounts of Pd. The results follow the behaviour observed in the (Ag–Au)–Yb system and provide qualitative support for the Intermediate Valence State model of Yb. (auth)

6623 BIAXIAL CREEP MEASUREMENT OF THIN WALLED TUBES. Caly, D. (Central Electricity Generating Board, Berkeley, CA). J. Mater. Sci.; 9: No. 8. 1275-1278(Aug 1974).

Special features of the design and operation of an apparatus to monitor the biaxial strain of thin walled tubes continuously at temperatures up to 1000°C are described. Secondary creep measurements obtained on circumferentially ribbed tubes of 20/25/Nb stainless steel, used as reactor fuel cladding, are shown to be consistent with recent uniaxial data for the same material, when the biaxial results are expressed in terms of a generalized hoop stress. (auth)

6624 LOW-TEMPERATURE ELECTRICAL PROPERTIES OF V_2Ga_5. Cruceanu, E.; Antesberger, G.; Papastaikoudis, C. (Kernforschungsanlage Juelich, GmbH, Ger.). Solid State Commun.; 15: No. 6, 1047-1049(15 Sep 1974).

Electrical and magnetic measurements are reported for V_2Ga_5 crystals. A transition to the superconducting state was observed at 4.2 K. The temperature dependence of the critical fields and the Ginzburg-Landau parameter κ were also determined. Information is also given about the temperature dependence of the ideal electrical resistivity between 10 and 300 K. (auth)

6625 SUPERCONDUCTING PROPERTIES OF $Pb_xSn_{1-x}Te$. Gubser, D. U.; Hein, R. A. (Naval Research Lab., Washington, DC). Solid State Commun.; 15: No. 6, 1039-1042(15 Sep 1974).

Superconducting transition temperatures and critical magnetic field curves on low carrier concentration $Pb_xSn_{1-x}Te$ samples where $0.25 \leq x \leq 0.55$ are reported. These data are interpreted in terms of a changing band structure from that of SnTe to one which is similar to that of GeTe. The importance of carriers (holes) in secondary maxima of the valence band is emphasized. (auth)

6626 NORMAL STATE ATTENUATION IN TIN-INDIUM SYSTEM. Mukerjee, A. K.; Chaudhuri, K. D. (Univ. of Delhi). Solid State Commun.; 15: No. 6, 1085-1086(15 Sep 1974).

Residual resistivity values were calculated from the normal state attenuation in tin-indium system. These show that the system follows Nordheim's rule. (auth)

6627 SELF-DIFFUSION IN γ BCC LANTHANUM: POSSIBILITY OF 4f CHARACTER IN LANTHANUM. Languille, A.; Calais, D.; Coqblin, B. (CEN, Fontenay-aux-Roses, France). J. Phys. Chem. Solids; 35: No. 11, 1461-1467(Nov 1974).

Self-diffusion measurements in body-centered cubic γ lanthanum give an activation energy of 29.9 kcal/mole, much smaller than that deduced from the Van Liempt law. It is proposed that this anomalous self-diffusion occurs by an interstitial mechanism, i.e. a mechanism of crowdion type, the formation of which is due to a small 4f character in lanthanum metal. (auth)

6628 SPECIFIC HEAT CAPACITIES OF BORON-CONTAINING ALLOYS AND CERMETS OF ZIRCALOY-2, AND RELATED THERMODYNAMIC PROPERTIES OF ZIRCONIUM. Casey, D. N.; Yates, B. (Univ. of Salford, Eng.). High Temp.–High Pressures; 6: No. 1, 33-46(1974).

The construction and operation of new apparatus for the adiabatic measurement of the specific heat capacities of good and poor thermal conductors in the range 300 to 800 K is described. Results obtained for high purity aluminum and sapphire have an internal consistency of ~0.6% and agree with established results in an absolute sense within ± 1%. The apparatus was used to measure the specific heat capacity of Zircaloy-2 between ~300 and 570 K, and also of five alloys of Zircaloy-2 containing up to 0.75 wt % boron and of three cermets of Zircaloy-2 containing up to 4 wt% boron in the form of tetraboron carbide, at ~323 K and ~573 K. An application of the quasiharmonic approximation to available thermodynamic data for the host element zirconium was undertaken in order to gain an insight into the vibrational properties of the less well characterized alloy Zircaloy-2. Conclusions concerning the possibility of calculating the specific heat capacities of the cermets from mass weighted contributions from the constituents are complicated by significant differences between experimental data available for tetraboron carbide at the present time. (auth)

6629 CRITICAL CURRENT-DENSITY OF Nb-60 AT% Ti AND Nb-25 AT% Zr SUPERCONDUCTORS IN SMALL MAGNETIC FIELDS. Hampshire, R. G. (Central Electricity Research

Labs., Leatherhead, Eng.). J. Phys., D (London); 7: No. 13, 1847-1863(1 Sep 1974).

The critical supercurrent in Nb–60 at % Ti and Nb–25 at % Zr wires was measured in low magnetic fields at temperatures $4.5\ K \leq T \leq T_c$, conditions relevant to a superconducting cable. The wires, only 30 μm in diameter, had a small critical current so that the self-field of the current did not significantly distort the applied field. At 4.5 K and 0.5 T the critical current density in as-worked wires was $J_c = 2.2\ kA\ mm^{-2}$ (Nb–25 at % Zr) and $J_c = 1.0\ kA\ mm^{-2}$ (Nb–60 at % Ti). Annealing the Nb–60 at % Ti at 385°C multiplied the critical current by six. The pinning force on unit volume of the vortex lattice obeys the same empirical relation found in large fields: $P_v = f(b)g(B_{c2})$ where $b(= B/B_{c2})$ is the reduced magnetic field, and the relation fits the data for $b \gtrsim 0.006$. $g(B_{c2})$ is approximately equal to B_{c2}, where $n \simeq 2$. A small-field form of a κ-pinning theory which has been developed fits the data well, whereas other published theories do not. However, the theory ignores the rigidity of the vortex lattice and, since this feature is thought to be important, the success of the theory may indicate a fault in our understanding of flux pinning. (auth)

6630 PRESSURE AND TEMPERATURE DERIVATIVES OF THE ISOTROPIC POLYCRYSTALLINE SHEAR MODULUS FOR 65 ELEMENTS. Guinan, M. W.; Steinberg, D. J. (Univ. of California, Livermore). J. Phys. Chem. Solids; 35: No. 11, 1501-1512(Nov 1974).

Experimental values are tabulated for the temperature derivative of the isotropic polycrystalline shear modulus for 47 elements and for the pressure derivative for 39 elements. Equations are derived to estimate these derivatives, and the estimated values generally compare well with the experimental data. These equations were used to determine pressure and temperature derivatives of the isotropic polycrystalline shear modulus for other elements for which no experimental data are available. The elements dealt with include the following of interest in nuclear technology: Be, Cd, Ce, Cs, Dy, Er, Eu, Gd, Hf, Ho, In, La, Lu, Mo, Nb, Nd, Pr, Ru, Sc, Sm, Ta, Tb, Te, Th, Tl, Tm, U, V, W, Y, Yb, Zr. (auth)

6631 RARE-EARTH COMPOUNDS WITH MIXED VALENCIES. Mott, N. F. (Cambridge Univ., Eng.). Phil. Mag.; 30: No. 2, 403-416(Aug 1974).

The properties of certain rare-earth compounds in which the 4f band has mixed valency, notably SmB_6 and the high-pressure forms of SmS, SmSe and SmTe are reviewed. The metal-insulator transitions of the last three materials under pressure are discussed. It is suggested that the low-pressure form of SmS is an excitonic insulator. In SmB_6 and high-pressure SmS a very small gap separates occupied from unoccupied states, this in our view being due to hybridization of 4f and 5d bands. The electrical properties are discussed; if kT is greater than the gap energy, then the gap does not affect the metallic behavior. Finally metallic compounds such as $CeAl_3$ are described, in which there is no magnetic ordering at low temperatures, and it is suggested that this must always occur if the Kondo temperature is higher than the RKKY interaction. In this case, as in compounds with mixed valency, the Fermi energy will pass through the 4f band, and there is a very large enhancement of the effective mass. The relationship to the side-band model is discussed. (auth)

6632 MAGNETIC AND SUPERCONDUCTING PROPERTIES OF THE SYSTEM $Mo_{77}Ir_{23-x}Fe_x$. Fischer, O.; Treyvaud, A.; Bongi, G.; Jones, H.; Fluekiger, R. (Univ., Geneva). J. Phys., F (London); 4: No. 8, 1187-1203(Aug 1974).

It is found that Fe is magnetic when introduced as an impurity in the A15 superconductor $Mo_{77}Ir_{23}$. The susceptibility of the Fe impurity follows a Curie-Weiss law, which can be understood in terms of short range interactions. The superconducting properties can be explained in terms of standard pairbreaking theories including a negative exchange field and the effects of the short range ordering. From this influence of the magnetic impurities on the superconducting properties the Maki parameter α and the spin-orbit parameter λ_{SO} for the pure sample were determined. (auth)

6633 HYPERFINE FIELDS AND MAGNETIC COUPLING IN Gd METAL. Campbell, I. A.; Brewer, W. D.; Flouquet, J.; Benoit, A.; Marsden, B. W.; Stone, N. J. (CNRS, Orsay, France). Solid State Commun.; 15: No. 4, 711-714(15 Aug 1974).

New hyperfine field measurements on transition metal impurities in Gd are reported. The data cannot be explained on a simple RKKY model, but are consistent with a mechanism in which magnetic coupling is through the d electrons. (auth)

6634 LOCATION OF UNOCCUPIED 4f STATES IN RARE EARTH METALS. Padalia, B. D.; Fabian, D. J. (Strathclyde Univ., Glasgow). J. Phys., F (London); 4: No. 8, L179-L180 (Aug 1974).

Results concerning the location of unoccupied 4f levels in rare earth metals reported by Padalia et al. (J. Phys. F. Metal Phys.; 4: 938(1974)) are re-examined. (auth)

6635 PHASE IDENTIFICATION IN THE COBALT–SAMARIUM SYSTEM WITH COMPUTER-SIMULATED ELECTRON DIFFRACTION PATTERNS. Rao, P.; Goehner, R. P. (General Electric Co., Schenectady, NY). J. Appl. Crystallogr.; 7: No. 5, 482-488(1 Oct 1974).

Computer-simulated electron diffraction patterns can be effectively utilized in phase identification in complex alloy systems. The problem of phase identification becomes particularly acute when several alloy phases with related lattice parameters coexist, resulting in overlapping diffraction spots. Such overlapping patterns can make unambiguous phase identification tedious, if not impossible. A complex alloy such as cobalt–samarium, is ideally suited for such study. Computer-simulated diffraction patterns have been used to identify the presence of rhombohedral $Co_{17}Sm_2$ and a disordered Co_7Sm_2 type structure in annealed Co_5Sm single crystals. Apart from the ease in identification of coexistent phases, computation of electron diffraction patterns also help in confirming the indexing of complex patterns especially when several phases can be expected to be present. The use of the cobalt–samarium system for an indirect method of crystal-thickness measurement is discussed. (DE)

6636 CRYSTAL STRUCTURE OF Er_3Ni_2. Moreau, J. M. (Univ., Geneva); Paccard, D.; Gignoux, D. Acta Crystallogr., Sect. B; 30: No. 9, 2122-2126(15 Sep 1974).

Er_3Ni_2 is rhombohedral, space group $R\bar{3}$, Z = 9 for the hexagonal cell, with a = 8, 472, c = 15.680Å. The high-temperature phase of Ho_3Ni_2 is isotypic (a = 8.52, c = 15.75Å). Intensity measurements were made on a four-circle diffractometer. The structure was solved by Patterson methods and refined by full-matrix least-squares calculation. R with isotropic thermal parameters, is 0.11 for 486 observed reflexions. Interatomic distances for Er–Er range from 3.28 to 3.92Å, for Er–Ni from 2.75 to 3.27 Å and there is one Ni–Ni contact of 2.54 Å. Erbium atoms occur in three independent sets with coordination 14 for Er(2), and 16 for Er(2) and Er(3). Nickel atoms occur in one set with coordination 9. (DE)

6637 SOFT X-RAY SPECTRA OF VANADIUM, NIOBIUM, AND THE ALLOYS V_3Sn AND Nb_3Sn. Hague, C. F.; Bonnelle, C. pp 251-257 of Band-structure Spectroscopy of Metals and Alloys. Fabian, D. J. (ed.). London; Academic Press (1973).

From international conference on band-structure spectroscopy of metals and alloys; Strathclyde, England (Sep 1971).

The distribution of electrons in the d-bands was studied by the examination of Lα-emission band for V and V_3Sn and of Lβ-band for Nb and Nb_3Sn by soft x-ray spectrometry. The results underline the important role of oxidation when the spectra of intermetallic compounds are obtained by electron bombardment. Such effects were almost completely eliminated when fluorescence spectroscopy was employed. (Metals Abstr.)

6638 X-RAY SPECTRA AND ENERGY BAND STRUCTURE OF BINARY ALLOYS OF VANADIUM WITH THE ELEMENTS AT THE END OF THE TRANSITION SERIES. Nemnonov, S. A. pp 237-250 of Band-structure Spectroscopy of Metals and Alloys. Fabian, D. J. (ed.). London; Academic Press (1973).

From international conference on band-structure spectroscopy of metals and alloys; Strathclyde, England (Sep 1971).

The energy-band structure of binary alloys of V with Fe, Co, Ni, Ru, Rh, Pd, OS, Ir, or Pt were studied and the distribution of electron states with different types of symmetry was observed. The results of x-ray spectroscopic examination indicated that the electronic structure of binary alloys of V with the elements at the end of the first transition series characterizes the energy separation of valence bands associated with the different constituents. The high-energy bands arise from the 3d-states of V atoms and the low-energy bands from the d-states of the heavier constituent. (Metals Abstr.)

6639 PREPARATION OF SAMARIUM–COBALT PERMANENT MAGNETS. Walkiewicz, J. W.; Winston, J. S.; Wong, M. M. Report of Investigation No. 7784. Washington, DC; Bureau of Mines (1973). 18p.

Studies were conducted to develop a method for fabricating Sm–Co permanent magnets. This method consisted of arc-melting, crushing and grinding the alloy, aligning and pressing the power and sintering the green compacts. Results indicated that the optimum composition was 36.7 ± 0.3 wt.% Sm and 63.3 ± 0.3 wt.% Co. This composition was obtained by blending together Sm_2O_3 and $SmCo_5$. The maximum values experimentally obtained were ${}_MH_c = 27.4$ kOe, ${}_BH_c = 7510$ Oe, $B_r = 7810$ G, and $(BH)_{max.} = 15.1$ MGOe. The optimum sintering temperature and grinding times for maximum ${}_MH_c$ and (BH)maximum were determined. Lowering the grinding temperature from 0 to -60°C resulted in a significant increase of magnetic properties. (Metals Abstr.)

6640 DIFFUSION OF ZIRCONIUM IN ALUMINUM. Marumo, T.; Fujikawa, S.; Hirano, K. I. Keikinzoku; 23: No. 1, 17-25(Jan 1973). (In Japanese).

Diffusivities of Zr in polycrystalline high-purity Al, Al–0.063 at.-% Fe, and Al–0.18 at.-%Si alloys, were determined by the residual-activity method in the range 530 to 650°C. The pre-exponential factors and the activation energies are very similar to those for diffusion of Fe, Mn, or Cr in pure Al. (Metals Abstr.)

6641 EQUILIBRIUM DIAGRAM OF THE Al–Si–Be SYSTEM. Nishi, S.; Shinoda, T.; Wade, N. Keikinzoku; 22: No. 12, 716-722 (Dec 1972). (In Japanese).

The Al–Be and Al–Si–Be systems were studied by means of electrical-resistivity measurements, microprobe analysis, and microscopic examination. The solubility of Be in Al decreased rapidly with temperature from 0.25% at 630 to 0.07% at 560°C.. A peritecto-eutectic reaction (expressed as liquid + Be = Al + Si at 571°C) is proposed for the Al–Si–Be system, at a composition of 13% Si and 0.5% Be. (Metals Abstr.)

6642 RESISTANCE OF SUPERCONDUCTING-NORMAL INTERFACES. Harding, G. L.; Pippard, A. B.; Tomlinson, J. R. (Cambridge Univ., Eng.). Proc. Roy. Soc. (London), Ser. A; 340: No. 1620, 1-31(3 Sep 1974).

The work of Pippard, Shepherd & Tindall (Proc. R. Soc. Lond.; A 324: 17(1971)) on the resistance of copper foil sandwiched between superconducting lead electrodes was extended (1) to study the influence of alloying the lead with bismuth, and (2) to investigate other pairs of metals, Pb–Re, Pb–Mo, Pb–Al, Pb–Sn, Sn–Al. In addition, different techniques for depositing lead electrodes on copper foil were investigated; evaporation in vacuo after cleaning the copper surface by sputtering was found to give the most consistent results and minimal oxide contamination at the metallic interface. Thin oxide layers give rise to a characteristic rise in the resistance of the sandwich as the temperature is lowered well below the superconducting transition. The behavior is fairly consistent with a simple model in which regions of metallic contact carry current in parallel with tunnel junctions; the conductivity of the latter is much higher than for oxide layers used for experiments on superconducting tunnelling, and it is conjectured that they are monomolecular. The rise of resistance towards the transition temperature of lead, as observed by Pippard, et al., becomes more marked when bismuth is added to the lead, but reaches a limiting behavior with 5% Bi which is maintained up to 20% Bi, at which point the behavior becomes less reproducible, as might be expected with a two phase superconducting electrode. The resistance of the sandwich at the lowest temperatures is also somewhat increased by the addition of bismuth to the lead. (auth)

6643 DETERMINATION OF THE PHASE DIAGRAM OF THE Mo–Fe SYSTEM USING DIFFUSION COUPLES. Heijwegen, C. P.; Rieck, G. D. (Eindhoven Univ. of Tech., Netherlands). J. Occup. Med.; 37: 115-121(1974).

The phase diagram of the Mo–Fe system between 800 and 1300°C has been determined using diffusion couples consisting of the pure metals or their alloys. The boundary concentrations were measured with an electron probe micro-analyzer. The μ-(Fe_7Mo_6) phase has a homogeneity range from 57 to 61.5 at.% Fe; above 1250°C the Fe-rich boundary shifts towards the Mo-rich side. The R-phase is stable above 1200°C. Its Fe-rich boundary lies at 65 at.% Fe and is vertical, but the Mo-rich one shifts from 65 at.% Fe at 1200°C to 62 at.% Fe at 1300°C. The σ-phase is stable above about 1235°C and contains about 45 at.% Fe. α-Fe can dissolve 17.9 at.% Mo and Mo 8 at.% Fe at 1300°C. (auth)

6644 CREEP RESISTANCE AND EMBRITTLEMENT OF A Ti–6%Al–5%Zr–1%W–0.4%Si ALLOY. Imbert, Y. (SNECMA, Corbeil, France). J. Less-Common Metals; 37: 71-89(1974).

Precipitation of titanium and zirconium silicides occurs in the alloy Ti–6Al–5Zr–1W–0.4Si during extended heating in the 450 to 550°C temperature range. When the alloy is quenched from the β-field, i.e., when the structure is martensitic, some medium-sized silicides are aligned along the martensite plates and are responsible for the loss of tensile ductility after extended heating. Other silicides, which are thinner, precipitate on dislocations within the plates and increase the creep resistance, in addition to the increase due to solute silicon atoms; the early nucleation of the orientated silicides implies a strong relationship between the improved creep resistance and embrittlement in silicon-containing titanium alloys. When the alloy is cooled from the ($\alpha + \beta$) field, large silicides precipitate during creep and the creep resistance is not then improved by the silicon addition. An ordering reaction is also observed during exposure in the same temperature range, whatever the initial structure. It reaches a maximum near 560°C and leads to the precipitation of $\alpha_2(Ti_3Al)$ particles on some dislocations, but does not induce any embrittlement. The tests have also shown that embrittlement by ω-phase, by surface contamination, or by hydrogen are not significant in this case. (auth)

6645 DOMAIN STRUCTURE IN Ni_4Mo ALLOY. Saburi, T.; Kanai, E.; Nenno, S. (Osaka Univ.). J. Less-Common Metals; 37: 59-70(1974).

Microstructural changes of Ni_4Mo alloy during isothermal aging at 800°C were followed by using electron microscopy. The transition from short-range, ordered α-phase (as quenched) to the long-range, ordered β-phase was found to take place by random nucleation and growth of β-phase domains in the α-matrix. After impingement, β-domains coalesce towards a configuration characterized by perpendicular twin plates which are arranged side by side parallel to {110}-type planes. Each of the perpendicular twin plates consists of two types of anti-parallel, twin-related domains. (auth)

6646 ZrCo AND RELATED TERNARY PHASES REPRESENTED BY THE GENERAL FORMULA, $Zr_{50}Co_{50-x}Ni_x$. Hossain, D. (Univ. of Birmingham, Eng.); Harris, I. R.; Barraclough, K. G. J. Less-Common Metals; 37: 35-57(1974).

As an essential preliminary to the study of the mechanical behavior and physical properties of some ternary intermediate phases represented by the general formula, $Zr_{50}Co_{50-x}Ni_x$ (where x represents the atomic percent, and varies from 0 to 50), the structure and constitution of these alloys have been investigated. Results of metallographic examination of the binary ZrCo phase indicates that it melts congruently and there is also evidence of a Widmanstätten-type precipitate and a eutectoid decomposition in the ZrCo phase after certain mechanical and heat treatments. The effect of substituting cobalt with nickel in the ternary alloys is to produce a room-temperature, martensitic structure at approximately the 14 at.% Ni composition. At certain temperatures, appreciable ductility is observed in the range 6 to 14 at.% Ni and the marked temperature dependence of the mechanical properties is thought to be related to the transformation characteristics of the ternary alloys. The electrical resistivity measurements in the temperature range 77-300°K indicate a possible low-temperature phase transition at the 10 and 12 at.% Ni compositions. (auth)

6647 EXTRA LOW CARBON FERRITIC STEELS FOR HIGH TEMPERATURE SODIUM SERVICE. Aplett, W. R. Jr.; Matejic, M. pp 131-154 of Low Carbon and Stabilized 2¼% Chromium 1% molybdenum steels. Metals Park, OH; American Society for Metals (1973).

From proceedings of the materials engineering congress; Cleveland, Ohio (19 Oct 1970).

Carbon transport problems associated with steels for use in high-temperature liquid Na service have stimulated investigation of means to reduce the C activity of ferritic Cr–Mo steels. Tensile and creep tests performed on three very low-C grades of 2¼% Cr–1% Mo material as one aspect of a search are reported. One grade was produced by decarburization (to 0.006% C) of plate samples in wet H at 900°C; the others were provided by fabrication of tubing from two heats melted to very low-C specifications (final C of 0.012% and 0.030%). The decarburized material proved to be the weakest in both tensile and creep properties. Heat treatment at 1204°C, however, contributed a marked increase in strength, even to above that of the tube materials, both in hot tensile tests and in creep tests at 510°C. (Metals Abstr.)

6648 Zr–3Nb–1Sn (CREEP-RESISTANT ALLOY). Alloy Dig.; Zr-6: 2p(Jan 1974).

Zr–3Nb–1Sn was developed for nuclear applications to obtain improved elevated temperature properties compared with the Zircaloys without reducing the corrosion resistance. Properties can be varied by changing the hot rolling temperature and the heat treatment procedures. Aging at 800°F yields the maximum creep strength; increasing the annealing temperature and decreasing the cooling rate improve ductility but decrease strength and corrosion resistance. Physical and mechanical properties (tensile properties at ~70 and 550°F, creep properties at 550°F, results of tensile and burst tests of tubes at 725°F tensile properties of welded materials, and minimum bend radii) are tabulated. Zr–3Nb–1Sn machines similarly to other Zr alloys. Workability and cleaning of the alloy are also given. (Metals Abstr.)

6649 IDENTIFICATION OF SECOND PHASES WITHIN BUBBLES IN ANNEALED DOPED TUNGSTEN WIRE. Snow, D. B. (General Electric Co., Cleveland). Met. Trans.; 5: No. 11, 2375-2381(Nov 1974).

Elemental potassium was detected within bubbles formed in annealed, commercially doped tungsten wire by transmission electron microscopy and selected area diffraction. The bubbles in specimens which had been annealed in hydrogen contained liquid potassium, solid potassium, and small quantities of potassium hydride. Only solid potassium was observed within

bubbles when specimens were annealed in $< 10^{-5}$ mm Hg vacuum. The potassium solidified epitaxially on the tungsten bubble surface and had virtually the same lattice orientation. The potassium hydride usually displayed a specific orientation relationship with the solid potassium and the tungsten. (auth)

6650 VISCOSITIES OF INDIUM–LEAD LIQUID ALLOYS. Rialland, J. F.; Perron, J. C. (CNRS, Fontenay-aux-Roses, France). Met. Trans.; 5: No. 11, 2401-2403(Nov 1974).

The viscosities of indium–lead alloys have been determined by using the Ostwald type viscometer. The values have been obtained by a relative technique since the viscometer has been calibrated with indium and lead. Isothermal viscosities show that the negative deviations from ideal mixing decrease with increase in temperature. The results are studied from the standpoint of thermodynamics. The temperature dependence can be described by Arrhenius relation. The activation energy depends on concentration and is close to 1.6 kcal/mole. In the studied temperature range, it has been established that the data can be fitted with Arrhenius relation and Andrade's equation. (auth)

6651 EFFECT OF HYDROGEN ON FRACTURE AND INERT-ENVIRONMENT SUSTAINED LOAD CRACKING RESISTANCE OF α-β TITANIUM ALLOYS. Meyn, D. A. (Naval Research Lab., Washington, DC). Met. Trans.; 5: No. 11, 2405-2414(Nov 1974).

The fracture toughness and resistance to inert-environment sustained load crack propagation of α-β titanium alloys are usually reduced by increased hydrogen contents. The range of hydrogen contents over which either fracture toughness or threshold stress intensity for sustained load cracking was observed to decrease with hydrogen content is small (0 to 50 ppM) for Ti–6 Al–4 V, but further increases in hydrogen content can cause an increase in cracking rates. Sustained load crack propagation is characterized by a mixture of microvoid coalescence with cleavage usually on a plane 12 to 15° from {0001} of the hcp α phase with some {0001} cleavage. Cleavage apparently initiates ahead of the main crack front within α grains, usually near apparent α-β interfaces. Atmospheric moisture is inert with respect to sustained load cracking, that is, it does not cause stress corrosion cracking. Sustained load cracking was demonstrated in Ti–8 Al–1 Mo–1 V, Ti–6 Al–6 V–2 Sn, and several grades of Ti–6 Al–4 V. (auth)

6652 DIRECTIONAL SOLIDIFICATION OF Pb–Sn–Cd ALLOYS. Holder, J. D. (Oak Ridge National Lab., TN); Oliver, B. F. Met. Trans.; 5: No. 11, 2423-2437(Nov 1974).

The growing interest in composite structures for new material applications makes it necessary to determine just how generally the existing solidification theory can be applied to controlled three-phase ternary solidification. The Pb–Sn–Cd ternary eutectic system was used as a model system to map the phase morphology as a function of thermal gradient/growth velocity (G/R) and compositions. By carefully controlling the freezing rate and the thermal gradient in the liquid ahead of the solid-liquid interface (in the range 400 to 500°C/cm) the following areas of interest were investigated: 1) the effect of growth velocity and composition on coupled structures, 2) ternary impurities and their effect on the minimum G/R for coupled growth in a binary system, 3) the effect of growth velocity and composition on the nonplanar interface structures, and 4) the adaptability of theories (the constitutional supercooling criterion and Cline's binary analysis) in predicting the region of coupled growth in a three-component eutectic system growing at steady-state. It was found that much of the one and two-phase directional solidification theory and terminology can be directly extended to a ternary eutectic system. This suggests a further extension to n-phase, m-component systems ($m \geq n$) with at least a qualitative understanding of the solidification process. (auth)

6653 INFLUENCE OF THE Co/Ni RATIO ON THE γ' AND γ'' PRECIPITATION IN Fe–Ni–Co–Ta ALLOYS. Cozar, R.; Pineau, A. (Ecole des Mines de Paris, Corbeil-Essonnes, France). Met. Trans.; 5: No. 11, 2471-2472(Nov 1974).

Precipitation hardening of Fe-base–Ni–Co–Ta alloys was studied and the influence of the precipitate composition on ordering in these phases was investigated. It was found that for e/a ratio (defined by the average per atom of the total number of electrons outside the inert gas shells) of < 8.65, a γ' triangular ordered phase is observed while for $e/a > 8.65$ a γ'' phase exists. It is concluded that at e/a ~8.65 the ordered structure of the close-packed layers changes from triangular to rectangular. (JRD)

6654 EXPLORATORY STUDY OF A ZIRCONIUM-MODIFIED, PRECIPITATION-STRENGTHENED NICKEL-30 COPPER ALLOY. Whittenberger, J. D. (Lewis Research Center, Cleveland). Met. Trans.; 5: No. 11, 2359-2364(Nov 1974).

A precipitation-strengthened alloy has been produced through minor additions of zirconium to a base Ni–30 Cu alloy. The results of this exploratory study indicate that thermomechanical processing of a solution-treated Ni–30 Cu–0.2 Zr alloy produced a dispersion of precipitates. The precipitates have been tentatively identified as a Ni_3Zr compound. Comparison of the mechanical properties, as determined by testing in air, of the Zr-modified alloy to those of a Ni–30 Cu alloy reveals that the precipitation-strengthened alloy has improved tensile properties to 1200°K and improved stress-rupture properties to 1100°K. The oxidation characteristics of the modified alloy appeared to be equivalent to those of the base Ni–30 Cu alloy. (auth)

6655 SUBCRITICAL CRACK GROWTH UNDER SUSTAINED LOAD. Williams, D. N. (Columbus Lab., OH). Met. Trans.; 5: No. 11, 2341-2358(Nov 1974).

Compact tension specimens of annealed Ti–4 Al–3 Mo–1 V were exposed under sustained load for periods of up to 8 days to determine the effects of initial stress intensity and test environment on subcritical crack growth. Crack growth occurred by a tunneling process with no surface crack extension until just prior to final rapid failure. Crack growth in vacuum or moist air environments occurred at stress intensities as low as 40% of the fracture toughness, and there was no evidence of a threshold stress intensity below which crack growth would not occur. Specimens tested in salt water behaved similarly at stress intensities of greater than about 60% of the fracture toughness, but showed crack arrest at lower stress intensities. At lower stress intensities, resistance to crack growth in a saltwater environment was superior to that in vacuum or moist air. Subcritical crack growth was readily identified on the fracture surface after exposure in all three environments through the presence of numerous cleavage-like facets. A critical strain concept, with crack growth occurring as a result of creep processes, can be used to explain the results. (auth)

6656 MECHANICAL PROPERTIES OF HIGH PURITY Fe–26 Cr–1 Mo FERRITIC STAINLESS STEEL. Franson, I. A. (Airco Inc., Murray Hill, NJ). Met. Trans.; 5: No. 11, 2257-2264(Nov 1974).

From symposium on new developments in ferritic and duplex stainless steels; Cleveland, OH (19 Oct 1972).

The physical metallurgical characteristics of high purity Fe–26 Cr and Fe–26 Cr–1 Mo ferritic stainless steels, containing low carbon and nitrogen contents, were studied. Results of the studies demonstrate that a commercially produced Fe–26 Cr–1 Mo high purity alloy containing a maximum of 50 to 150 ppM of carbon and nitrogen is capable of good mechanical properties and fabricability. The alloy was previously demonstrated to exhibit good corrosion resistance. Because of these properties, the high purity Fe–26 Cr–1 Mo alloy is a viable alternate to 300-series stainless steels as well as more highly alloyed materials for many applications. (auth)

6657 MECHANICAL PROPERTIES AND WELDABILITY OF A NIOBIUM STABILIZED STEEL WITH 2¼% CHROME AND 1% MOLYBDENUM FOR SODIUM-COOLED FAST REACTOR SYSTEMS. Egnell, L. pp 47-55 of Low Carbon and Stabilized 2¼% Chromium 1% Molybdenum Steels. Metals Park, OH; American Society for Metals (1973).

From proceedings of the materials engineering congress; Cleveland, Ohio (19 Oct 1970).

A Nb-stabilized steel with the composition 0.08% C, 0.3% Si, 0.5% Mn, 2.3% Cr, 0.5% Ni, 1% Mo, and 0.9% Nb has been developed to avoid C loss to the Na in Na-cooled fast reactor systems. Results of tests have shown that the addition of Nb to this steel produces a greater response of the tensile and creep rupture properties to heat treatment. Results of further tests suggest that welding problems should not occur as a result of the properties of the parent metal in welded joints. However, the possibility of NbC precipitation hardening in heat affected zones produces an inherent risk of reheat cracking. (Metals Abstr.)

6658 DEVELOPMENT AND PROPERTIES OF A FERRITIC STEEL FOR SODIUM COOLED REACTORS WITH 2¼% Cr, 1% Mo AND A NIOBIUM ADDITION. Kranz, E.; Fabritius, H.; Lorentz, K. pp 13-36 of Low Carbon and Stabilized 2¼% Chromium 1% Molybdenum Steels. Metals Park, OH; American Society for Metals (1973).

From proceedings of the materials engineering congress; Cleveland, Ohio (19 Oct 1970).

X-ray diffraction, dilatometry, thermomagnetic measurements, carburization studies, mechanical tests, and other techniques were used to develop a ferritic steel containing 2¼% Cr, 1% Mo and a Nb addition for Na-cooled reactors. Graphs illustrate creep strength, resistance to decarburization, transition temperature, impact strength, tensile strength, proof stress, and hardness of the steel alloys tested as a function of temperature,

heat treatment, Nb content, and C content. Tests were also performed on welded specimens to determine impact strength, crack susceptibility, and the structure of the heat affected zone. (Metals Abstr.)

6659 STUDY OF THE EMBRITTLEMENT OF 2¼ Cr-1 Mo STEEL WELD METAL. Swift, R. A. Philadelphia; Drexel Univ. (1974). 203p. University Microfilms Order No. 74-26,678.

Thesis (Ph. D.).

A study of the effects of post welding heat treatments on the mechanical properties of a multipass submerged arc weld of 2¼ Cr–1 Mo steel confirms that three types of embrittlement can occur. These are post weld heat treatment embrittlement by precipitation hardening, temper embrittlement, and creep embrittlement. The mechanisms of post weld heat treatment embrittlement by precipitation hardening and creep embrittlement by non-equilibrium segregation of residual elements in prior austenite grain boundaries have been identified. The three types of embrittlement are interrelated although their mechanisms are different. Post weld heat treatment embrittlement and temper embrittlement can occur simultaneously and both can reduce creep rupture ductility. However, if a weld is temper embrittled prior to creep, the rupture ductility is improved. This interaction is consistent with the mechanism of temper embrittlement involving non-equilibrium segregation of residual elements proposed by Rellick and McMahon. The brittle fracture mode when both post weld heat treatment embrittlement and temper embrittlement are present is dependent upon which type of embrittlement is most severe. Since they can occur simultaneously the type of embrittlement requiring the lowest stress to fracture is the one that controls the fracture mode. (Diss. Abstr. Int., B)

6660 AMDRY 754 (NICKEL-BASE HARDFACING ALLOY). Alloy Dig.; Ni-99: 2p(Jan 1974).

Amdry 754 Ni alloy containing 0.35 to 0.55% C, 8.50 to 11.5% Cr, 1.00 to 2.00% B, 2.50 to 3.75% Si and 4.00 to 6.00% Fe was formulated to provide good resistance to combinations of abrasion, corrosion, heat, impact shock and oxidation. The alloy cannot be hardened, tempered or annealed by any treatment. It has excellent machinability characteristics. It may be sprayed with any contemporary flame spray torches. As-sprayed deposit is very porous and has a mechanical bond with the base metal. After fusing, the deposit is very dense and metallurgically bonded to the base metal. Physical and mechanical properties of deposits and applications are given. (Metals Abstr.)

6661 EXCITATION OF GIGAHERTZ MAGNETOELASTIC WAVES IN DYSPROSIUM AND GADOLINIUM. Wang, J. T. Notre Dame, IN; Univ. of Notre Dame (1974). 133p. University Microfilms Order No. 74-23,472.

Thesis (Ph. D.).

Excitation of gigahertz magnetoelastic waves in dysprosium and gadolinium has been studied in the frequency range from 10.38 to 25.4 CHz at 1.5°K. A rectangular rod of SrF_2 doped with 0.02 per cent Tm^{++} has been used to detect phonons generated in the samples which were attached to one end of the detector. Static and rf magnetic fields were applied in the plane of the sample, and in addition to biasing the specimens, the static field was used to tune the spin-phonon spectrometer. The static magnetic field could be rotated in the plane of the sample to investigate the angular dependence of the phonon signal intensity. A simple classical analysis has shown that transverse phonons can be generated at the rf field frequency, and both transverse and longitudinal phonons can be generated at the second harmonic of the rf field frequency. A more detailed quantum mechanical coupled normal mode treatment was used to calculate signal intensities for perpendicular and parallel field configurations. For parallel static and rf magnetic fields, broad-banded phonons should be observed, if the threshold conditions for parallel pumping are not satisfied. If the threshold conditions are satisfied, the phonon signal will exhibit a narrow bandwidth and a maximum at a finite temperature. The phonon signal intensity for a dysprosium film as a function of frequency varying from 10.38 to 25.4 GHz has been measured, and the signal intensity was found to decrease with increasing frequency as predicted by the magnetoelastic mode analysis. The experimental signal intensity was approximately one-quarter of the calculated value which was based on single crystal parameters. The agreement between theory and experiment was substantially improved with an approximate renormalization. This result appears to quantitatively verify the coupled mode theory. The phonon signal intensity for single crystal c-plane platelets of dysprosium as a function of the angle between static and rf magnetic fields for several different frequencies has been measured. It was found that the phonon signal intensity falls into two categories. For rf field frequencies lower than 16.7 GHz (3.7 kOe), the phonon signal intensity remained almost constant for all angles. At a frequency of 16.774 GHz (3.75 kOe), the signal intensity was approximately constant until the angle between the rf and static fields was approximately 60°, at that point, the signal intensity dropped by approximately 67%. The result has been interpreted as arising from a jump of the magnetization from one easy direction to the next. With perpendicular static and rf magnetic fields, the phonon signal intensity from gadolinium crystals was within –7 db of the predicted value. The difference is attributed to insertion loss in the acoustic bond. Phonon generation at the rf field frequency in gadolinium crystals with parallel static and rf magnetic fields has also been observed. Interpretation of data suggested that parallel pumping threshold conditions must be satisfied, otherwise, broad-band phonons should have been observed. In general, the coupled mode description appears to be in excellent agreement with experiments. (Diss. Abstr. Int., B)

6662 ULTRASONIC STUDIES OF MIXED STATE SUPERCONDUCTIVITY IN NIOBIUM. Purvis, M. K. Amherst, MA; Univ. of Massachusetts (1974). 203p. University Microfilms Order No. 74-25,917.

Thesis (Ph. D.).

Ultrasonic attenuation studies of the mixed state of two niobium single crystal samples have been conducted. The purpose has been to examine the attenuation behavior corresponding to theoretical calculations of Houghton and Maki and of Cerdeira and Houghton. These calculations are used to examine the dependence of the ultrasonic attenuation in the vicinity of the upper critical field H_{c2} on ultrasonic frequency, electronic mean-free-path, propagation geometry, and magnetic field. The higher purity sample studied (residual resistivity ratio 2665) showed marked frequency dependence of normalized attenuation at frequencies from 10 to 100 MHz. The other sample (residual resistivity ratio 68) showed qualitatively similar but less pronounced frequency dependence at frequencies ranging from 10 to 435 MHz. In both samples the observed frequency dependence was in qualitative agreement with Cerdeira and Houghton. Quantitative comparison of the results in the less pure sample with the predictions of Houghton and Maki showed agreement within a factor of two at temperatures of 4.2 and 1.4°K. The purer sample showed excellent quantitative agreement at 4.2, but at 1.4 K there was disagreement by factors of from two to six for various propagation geometries. A suggestion for the possible source of this discrepancy based on Scharnberg's analysis of the theoretical framework employed in the two sets of calculations is provided. Houghton and Maki predictions of the attenuation dependence on the geometry of ultrasonic propagation, polarization, and magnetic field orientation are also examined. In addition a continuous wave ultrasonic spectrometer capable of simultaneous and automatic measurement of small changes in the ultrasonic amplitude and the velocity of sound has been developed and is described. (Diss. Abstr. Int., B)

6663 INCONEL ALLOY 617. Huntington, WV; International Nickel Company, Inc. (1972). 8p.

Inconel alloy 617 is a solid-solution, Ni–Cr–Co–Mo alloy with an exceptional combination of high-temperature strength and oxidation resistance. The alloy also has excellent resistance to a wide range of corrosive environments and it is readily formed and welded by conventional techniques. The nominal chemical composition of Inconel alloy 617 is 54% Ni, 22.0% Cr, 12.5% Co, 9.0% Mo, 1.0% Al, and 0.07% C. The high Ni and Cr contents make the alloy resistant to a variety of both reducing and oxidizing media. The Al, in conjunction with the Cr, provides oxidation resistance at high temperature. Solid-solution strengthening is provided by the Co and Mo. The combination of high strength and oxidation resistance at temperature over 1800°F makes Inconel 617 an attractive material for gas-turbine aircraft engines and other applications involving exposure to extreme temperature. (Metals Abstr.)

6664 MECHANICAL PROPERTY TESTS FOR TUNGSTEN CARBIDE. Braiden, P. M. SME Technical Paper No. MR73-916. Dearborn, MI; Society of Manufacturing Engineers (1973). 14p.

Tests developed to determine the strength of brittle materials, such as WC, are described. Particular attention is paid to tests which provide biaxial tension/compression stress states, and a little-known test which is thought to be particularly important to the WC industry is fully described. In the test, values for the elastic constants may be obtained by means of strain gages; precautions necessary for accurate results are noted. It is concluded that biaxial tests are suitable for quality control applications. (Metals Abstr.)

6665 EMISSION-ADSORPTION CHARACTERISTICS OF THE RARE EARTHS FILMS ON SURFACE OF THE TUNGSTEN MONOCRYSTAL. Gorbatyj, N. A.; Garnov, A. V.; Karpachev, B. I.;

Reshetnikova, L. V.; Gazizov, R. F. (Tashkentskij Gosudarstvennyj Univ. (USSR)). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 2, 260-264(Feb 1974). (In Russian).

For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The results of studies on Se, Pr, Sm, and Yb films on the surfaces of sharp tungsten monocrystals are presented, and results obtained earlier in studies on the behavior of rare earth atoms on tungsten monocrystal faces are correlated. The individual properties of the rare earths (ionization potential, type of lattice, heat of sublimation, etc.) do not appear to play an important role in distribution of the rare earth adsorbate on the surfaces of tungsten monocrystals. The generality of rare earth adsorption properties in anisotropy is determined by the structure of the electron shells, and the complexity of the electron structure determines the high sensitivity of the emission and adsorption properties of rare earth films to the structure of the substrate. (tr-auth)

6666 THE EFFECT OF SEQUENTIAL ALTERNATION OF STRUCTURES IN LIQUID PURE METALS. Filippov, E. S.; Timoshin, A. S.; Furmanov, G. P. (Moskovskij Inst. Stali i Splavov (USSR)). Izv. Vyssh. Ucheb. Zaved., Chern. Met.; No. 11, 141-146(1973). (In Russian).

For English translation see the journal Stal USSR.

Changes in viscosity, electrical conductivity, and density were studied as a function of temperature in the 1000°C melting-superheating interval for liquid Sn, Bi, In, and Ga. Physical properties of pure liquid metals changed stepwise as the temperature changed. Sharp changes were shown in viscosity (15%), electrical conductivity (5%), and density (3%) at three temperatures (T_1, T_2, and T_3) instead of monotonic exponential dependence for viscosity and electrical conductivity and strict linear dependence for density. The first transition, T_1, is at 120, 80, 100, and 150°C superheating for Sn, Bi, In, and Ga, respectively, and is related to destruction of the inherent structure of the solid phase (complete metallization at K = 12). The second, T_2, is at 320, 250, and 270°C superheating and is related to spread of the preferable coordination 12 and transition to the preferable coordination 8. The third, T_3, with 600-900°C superheating, is related to going from the preferable coordination 8 to statistical packing with K = 6.5 - 5.5. The temperature of the region of existence of a close series was divided into structural zones between T_1, T_2, and T_3. The stability of preferable coordination (12, 8, 6) in the zone is related to the high incompressibility of free volume, strictly determined for each coordination. The ratio of temperatures of neighboring structural conversions was shown by the division into zones. (tr-auth)

6667 NEW INTERMETALLIC PHASE IN THE W-Ni SYSTEM. Poulsen, K. E.; Rubaek, S.; Langer, E. W. Scr. Met.; 8: No. 11, 1297-1300(Nov 1974).

Intermediate phases observed during diffusion experiments involving W-Ni systems are reported. These phases include the known WNi_4 and WNi, and a new phase shown to have the composition W_2Ni. The intermetallic WNi_4 phase was observed at annealing temperatures up to 1000°C. The W_2Ni phase was observed at temperatures ranging from 800 to 1040°C in specimens heat-treated in vacuum and argon atmosphere. A revised W-Ni phase diagram is included. (JRD)

6668 RETENTION OF A METASTABLE BCC γ-Np SOLID SOLUTION: γ-Np(Ga). Elliott, R. O. (Los Alamos Scientific Lab., NM); Russell, A. M.; Giessen, B. C. Scr. Met.; 8: No. 11, 1335-1340(Nov 1974).

The room-temperature retention of γ-Np solid solution, γ-Np (Ga), and lattice parameter values for this phase are reported. These data are used to evaluate the valence of Np in the high-temperature modification at room temperature without the uncertainty of an extended extrapolation of the coefficient of thermal expansion measured at high temperatures. (JRD)

6669 TEMPER EMBRITTLEMENT AND CREEP EMBRITTLEMENT OF 1.25 Cr-0.5 Mo STEELS CONTAINING Sb, Sn, P, AND B AS IMPURITIES. Viswanathan, R. (Westinghouse Research Labs., Pittsburgh). Scr. Met.; 8: No. 11, 1225-1229 (Nov 1974).

The effects of Sb, P, Sn, and B on the rupture ductility at 1000°F and the susceptibility to temper embrittlement of normalized and tempered 1.25 Cr-0.5 Mo steels were investigated. In stress rupture studies at 1000°F, presence of B caused an appreciable reduction of the rupture ductility, while large increases in concentration of Sb, P, and Sn had no discernible effect on rupture ductility, relative to the control heat. In temper embrittlement studies, on the other hand, larger changes in toughness following an embrittling treatment were observed due to Sb, P, and Sn than due to B. Further studies are needed to clarify if the mechanism of grain boundary embrittlement produced by B is different from that due to P, Sb, and Sn. (auth)

6670 EFFECT OF HEAT TREATMENT ON TEMPER EMBRITTLEMENT SUSCEPTIBILITY OF Cr-Mo-V STEELS. Viswanathan, R.; Shaw, B. J. (Westinghouse Research Labs., Pittsburgh). Scr. Met.; 8: No. 11, 1255-1260(Nov 1974).

The effect of transformation product and strength level (or hardness) on the temper embrittlement susceptibility of a Cr-Mo-V steel doped with P and Sn has been investigated. Martensite, bainite, and ferrite-pearlite structures were produced in samples by controlled cooling from austenite, tempered to specific hardness levels, then compared in terms of their fracture appearance transition temperature (FATT) before and after an embrittling treatment. Results show that different regions of strength levels exist, wherein FATT and the shift in FATT due to embrittlement (ΔFATT) may increase or decrease with increasing strength. At hardness levels below 10 R_C, ΔFATT values for bainite and for ferrite-pearlite structures approach each other. In the intermediate range of hardness level of 10 to 36 R_C tempered martensite structure has a low FATT but a large ΔFATT compared to tempered bainite. At hardness levels above 36 R_C, however, ΔFATT values for bainite and martensite become comparable. In general, steels which have a large FATT in the nonembrittled condition have a small ΔFATT resulting from embrittlement. (auth)

6671 CONNECTIVITY OF SUPERCONDUCTING PARTICLES IN THE HETEROGENEOUS ALLOY Cu(Nb_3Sn). Roberge, R.; McConnell, R. D. (Institut de Recherche de l'Hydro-Quebec, Varennes). Scr. Met.; 8: No. 11, 1267-1269(Nov 1974).

Composites in which each particle touches another so that a continuous sponge-like superconducting network is formed are described. The alloys are rich in Cu (typically 93 at.% Cu-5 at.% Nb-2 at.% Sn) and are prepared by either arc melting or induction heating. The superconducting critical temperature was found to correspond to that of Nb. After heat treatment Nb_3Sn is formed at the (Cu-Sn)/Nb interface which is superconductive at 18°K. (JRD)

6672 INFLUENCE OF NITROGEN ON THE DIFFUSION COEFFICIENT OF HYDROGEN IN NIOBIUM. Muenzing, W.; Voelkl, J.; Wipf, H.; Alefeld, G. (Technische Univ., Munich). Scr. Met.; 8: No. 11, 1327-1330(Nov 1974).

The influence of nitrogen impurities on the diffusion coefficient of hydrogen in niobium has been measured with the help of the Gorsky-effect technique. The data can be interpreted as if nitrogen in Nb suppresses the fast low-temperature diffusion process. (auth)

6673 ZIRCONIUM FOR NUCLEAR PRIMARY STEAM SYSTEMS. Webster, R. T. (Teledyne Wah Chang Albany, OR). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 5-13(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Zirconium and zirconium alloys provide the best combination of metallurgical and mechanical properties for light and heavy water nuclear reactor fuel cladding and for the primary steam generation equipment. However, before materials may be used in such applications, long-term mechanical properties within the reactor operating temperature range must be established. Also, fabrication methods for such systems must be developed and evaluated. In order that zirconium would become a qualified ASME Boiler Code material, a long-term test program was initiated; the qualifying data is presented in graphical form. The statistical data on short-term physical tests is amplified by the long-term creep rate and rupture-life versus temperature data. Primary steam generation equipment fabrication data and criteria are presented with examples. Examples of the use of zirconium and zirconium alloys in nuclear and nonnuclear structures is reported; the stages necessary to fabricate components for the large nuclear steam generation equipment used in commercial power production is discussed. Additional data required by international specifications is also presented, including charpy impact and fatigue data, as well as the normal mechanical property tests. (auth)

6674 DEVELOPMENT OF A CLOSED-END BURST TEST PROCEDURE FOR ZIRCALOY TUBING. Hardy, D. G. (Chalk River Nuclear Labs., Ont.); Stewart, J. R.; Lowe, A. L. Jr. Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 14-30(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The results of a round robin on the closed-end burst testing of Zircaloy tubes for fuel cladding are presented. Sponsored by the American Society for Testing and Materials, the testing program had as its objective the preparation of a suitable burst test procedure for inclusion in the ASTM Specification for Wrought Zirconium and Zirconium Alloy Seamless and Welded Tubes for Nuclear Service (B 353-71). Seventy-five specimens, cut from five lengths of tubing were tested at room temperature. Four laboratories took part and six different test methods were used.

It was found that the closed-end burst test can be used to characterize the biaxial mechanical properties of Zircaloy cladding tubes. The tests identified certain parameters as having a significant effect on the mechanical properties and which must be precisely defined in the specification; these include the internal mandrel geometry, strain rate, and system stored energy. The most desirable burst test apparatus is one which has low stored energy and which provides good control over the volume pumping rate producing a smooth pressure versus fluid volume output curve. (auth)

6675 DETERMINATION OF SOLID SOLUBILITY LIMIT OF HYDROGEN IN ALPHA ZIRCONIUM BY INTERNAL FRICTION MEASUREMENTS. Mishra, S.; Asundi, M. K. (Bhabha Atomic Research Centre, Trombay, India). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 63-71(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The general background internal friction variation with temperature is considered to be due to the oscillations of the dislocation segments in metal crystals. When these segments are strongly pinned by impurities or precipitates, then the background level reduces considerably. Under certain experimental conditions, zirconium hydride precipitates along the dislocations so as to pin the dislocation segments firmly. For a given composition of Zr–H alloy, the maximum temperature at which there is a measurable decrease in internal friction, due to precipitation, indicates the maximum solubility at that temperature. Thus, the solid solubility of hydrogen in iodide zirconium can be determined by a close study of the precipitation of hydride using the internal friction technique. Such a technique has been used to determine the solubility limit of hydrogen in iodide zirconium, Zr-0.25Gd and reactor grade sponge zirconium in the temperature range of 100 to 300°C. However, in the latter case the technique was found to be inadequate. (auth)

6676 DETERMINATION OF COMPLETE PLANE-STRESS YIELD LOCI OF ZIRCALOY TUBING. Dressler, G.; Drefahl, K.; Matucha, K. H.; Wincierz, P. (Metallgesellschaft AG, Frankfurt am Main). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 92-103(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The elastic and plastic anisotropy of commercially fabricated Zircaloy-4 cladding tubes has been determined for all four quadrants of the yield locus. The plane–stress yield locus has shown a significant asymmetry with regard to stresses created by internal or external pressurization, respectively. Knoop hardness tests are not suited for a description of the yield behavior of Zircaloy tubes. The anisotropy of the elastic properties has been evaluated as a function of the biaxial stress state. A proposed calculation model based on an extension of the general Hooke's law is suited to predict the elastic properties of textured Zircaloy tubes for biaxial stresses at room temperature, showing that the compliance constants determined for pure zirconium single crystals are also applicable for Zircaloy. The known temperature dependence of the compliance constants described less satisfactorily the elastic data measured at 400°C. (auth)

6677 EFFECT OF THERMOMECHANICAL PROCESSING AND HEAT TREATMENT ON THE PROPERTIES OF Zr–3Nb–1Sn STRIP AND TUBING. Curtis, R. E. (Teledyne Wah Chang Albany, OR); Dressler, G. Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 104-128(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The property response of Zr–3Nb–1Sn (weight percent) strip and tubing to variations in thermomechanical processing and heat treatment has been evaluated under commercial production conditions. When aged below the eutectoid temperature, that is, below 1100°F, cold-worked Zr–3Nb–1Sn strip and tubing were found to have out-of-reactor steam corrosion properties similar to the Zircaloys, while exhibiting superior tensile, creep, and formability characteristics. Creep was slower in Zr–3Nb–1Sn strip than in Zircaloy strip. Aging at 800°F maximized creep strength by precipitating fine ω particles in the β_{Zr} phase when β was present in the form of a network surrounding individual α_{Zr} platelets, that is, a Widmanstatten morphology. The Widmanstatten morphology was developed by either high temperature rolling or solution treatment. Increasing aging temperature and reducing cooling rate increased precipitate size and caused the β phase to agglomerate. These changes improved ductility and formability but decreased strength and corrosion resistance. However, increasing annealing time at 1050°F markedly improved corrosion properties. Good corrosion resistance in Zr–3Nb–1Sn is associated with a minimum volume fraction of β, enrichment of β in niobium, a small β-grain size, and a uniform distribution of the β phase. The welding characteristics of Zr–3Nb–1Sn were found to be similar to Zr–2.5Nb. In both alloys, post-weld heat treatment was effective in improving corrosion resistance and weld ductility while maintaining strength above base metal levels. (auth)

6678 POTENTIAL FOR IMPROVEMENT OF MECHANICAL PROPERTIES IN ZIRCALOY COLD-ROLLED STRIP AND SHEET. Kaufmann, P. D.; Baroch, E. F. (Teledyne Wah Chang Albany, OR). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 129-139(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

A summary of mechanical properties representing several thousand Zircaloy-4 channel blanks is presented. The data show a wide variation in elevated-temperature mechanical properties. Investigation of the effect of variations in ingot chemistry on mechanical properties is discussed. The effect of the elements carbon, silicon, tin, and oxygen on elevated-temperature yield strength is statistically significant, but does not account for the total magnitude of the variation in mechanical properties observed. Although it does not represent an actual material variation, tensile testing strain rate was found to have a very significant effect on elevated-temperature yield strength values. Further experimental work was performed to investigate the effect of fabrication variables on elevated-temperature yield strength. The most influential processing parameter on elevated-temperature yield strength of the resultant product was the hot-rolling temperature. A 20 to 30 percent variation in yield strength was observed between alpha-rolled and beta-rolled material. This variation existed even after subsequent cold rolling and recrystallization. The primary difference between these two products was shown to be the difference in preferred orientation. The elevated-temperature transverse yield strength and bend ductility were improved by beta rolling, while the product uniformity, corrosion resistance, and tensile elongation were decreased. The limitations as well as potential improvements in mechanical properties which could be obtained through processing variations are discussed. (auth)

6679 EFFECT OF THE ANNEALING TEMPERATURE ON THE CREEP STRENGTH OF COLD-WORKED ZIRCALOY-4 CLADDING. Frenkel, J. M.; Weisz, M. (CEN de Saclay, Gif-sur-Yvette, France). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 140-144(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Transverse creep strength of Zircaloy-4 tubing annealed in the range of 440 to 650°C has been evaluated by internal pressure tests, short-time control tests at 400°C, and long-time tests, as well as out-pile or in-pile, between 330 to 400°C. For low and intermediate stresses (lower than 133 MPa), it is observed that transverse creep strength increases while the annealing temperature is increased from 440 to 650°C. In-pile tests do confirm this trend. The effect of the annealing temperature on the yield and creep anisotropy of the tubes has been evaluated at 400°C. From these results, it is concluded that the beneficial effect of a recrystallization treatment on the creep strength of Zircaloy-4 tubes is related to an effect of texture variation. (auth)

6680 THERMOMECHANICAL CONTROL OF TEXTURE AND TENSILE PROPERTIES OF ZIRCALOY-4 PLATE. Dahl, J. M. (Climax Molybdenum Co., Ann Arbor, MI); McKenzie, R. W.; Schemel, J. H. Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 147-159(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The effects of controlling crystallographic texture, using a series of pseudoisothermal or falling temperature rolling schedules, on 315°C tensile properties of annealed 6.3-mm-thick Zircaloy-4 plate are discussed. Quantitative relationships between some tensile properties in both the longitudinal and the transverse directions and orientation parameters are reported. The 315°C elongation and reduction in area, in both directions, qualitatively follow the same type of second order relationship. The texture itself appears to depend on the average rolling temperature within three specific temperature ranges, probably as a consequence of changes in deformation mechanisms or changes in rolling stresses with changes in temperature. At temperatures near, but above the $\alpha/\alpha + \beta$ transus, the basal poles are nearly coincident with the transverse direction; at temperatures between the recrystallization temperature and the $\alpha/\alpha + \beta$ transus temperature, the basal poles approach the plate-normal direction; and at temperatures below the recrystallization temperature, the basal poles assume the usual cold-rolling orientation of 30 to 40° from the normal in the transverse plane. (auth)

6681 CREEP STRENGTH OF ZIRCALOY TUBING AT 400°C AS DEPENDENT ON METALLURGICAL STRUCTURE AND TEXTURE. Kaellstroem, K.; Andersson, T.; Hofvenstam, A. (Steel

Research Center, Sandvik AB, Sandviken, Sweden). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 160-168(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Zircaloy tubes were cold worked 50 or 80 percent to a series of textures and annealed at 475 to 575°C. Tube specimens were creep tested under internal pressure at 400°C with the transverse creep stress 152 MPa for 240 h, after which the transverse strain was measured. Annealing at 510 to 520°C in the temperature range of partial recrystallization gives maximum transverse creep strength. The creep strength maximum is higher the lower the degree of cold work. The high creep strength is caused by an optimum dislocation structure which is reached through recovery without copious recrystallization. Complementary creep tests under tensile load showed that the creep strength is lower transversely than longitudinally. This creep anisotropy may be explained in relation to texture by the action of ⟨1123⟩ dislocations. The transverse creep strength dependence on texture variations indicates that more radial basal poles give lower creep strength than more tangential basal poles. However, this texture effect is smaller than the effect of cold work, within the ranges of practical interest. (auth)

6682 PILGER TOOLING DESIGN FOR TEXTURE CONTROL. Schemel, J. H. (AMAX Specialty Metals Corp., Akron, NY); McKenzie, R. W. Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 169-178(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

It has been shown earlier that the crystallographic texture of a Zircaloy tube is determined by the ratio of wall reduction to diameter reduction during tube fabrication. The use of this ratio as applied mathematically to the starting tube size and the final tube size does not take into account the complex nature of the tapers in the tube reducing tooling. Instantaneous values of the reduction ratio along the tube transition are shown to vary widely in tools of conventional design. A tooling design scheme that holds the reduction or strain ratio constant is developed by mathematical integration of the basic premise. Data showing the results of various reductions made holding the reduction ratio constant are shown. These results indicate that the texture rotation is not a linear function of the reduction ratio, and there is a strong indication that the strain field is not homogeneous in thick-walled tubes. (auth)

6683 OPERABLE DEFORMATION SYSTEMS AND MECHANICAL BEHAVIOR OF TEXTURED ZIRCALOY TUBING. Tenckhoff, E. (Kraftwerk Union AG, Erlangen, Germany). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 179-200(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The slip and twinning systems known to operate in zirconium and Zircaloy are discussed with respect to the mechanical behavior of Zircaloy tubes. For extreme basal pole orientations in the radial and tangential directions, different stress-strain conditions in the tube cause different deformation systems to operate. The effects of the stress-strain conditions are discussed for axial tension and compression, internal and external pressure, axial bending, tube collapse, and axial torsion. The predictions of short time properties for strongly textured radial and tangential tubing are compared with experimental results. The method of taking tubes from a textured plate has proved suitable for studying texture as a parameter not only in the extreme positions discussed here but also at intermediate positions. This technique guarantees that other parameters, such as the degree of deformation and recrystallization, grain size, segregation, etc., are constant since all the variants of texture are present in one single tube. (auth)

6684 DIRECTIONALITY OF THE GRAIN BOUNDARY HYDRIDE IN ZIRCALOY-2. Kawanishi, H.; Ishino, S.; Mishima, Y. (Tokyo Univ.). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 201-211(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The correlation between hydride orientation and texture has been studied. Previous work showed that there are grain boundary habits such as $\{10\bar{1}1\}$, $\{10\bar{1}3\}$, and $\{10\bar{1}5\}$ for hydride precipitation in Zircaloy-2. By taking into account the stereographic configuration of these habits, the f_n-values of various specimens have been evaluated. Comparison between f_n-values obtained metallographically and by the present method gives excellent agreement. The mechanism of stress reorientation of hydride and the dependence of stress reorientation on stress direction are also discussed. (auth)

6685 COMPRESSIBILITY AND THERMAL EXPANSION OF HEAVY RARE EARTH METALS AND ALLOYS. Inoue, Chikara; Kadomatsu, Hideoki (Hiroshima Univ. (Japan). Faculty of Science); Fujii, Hironobu; Okamoto, Tetsuhiko. J. Phys. Soc. Jap.; 35: No. 5, 1322-1327(Nov 1973).

Linear compressibility and thermal expansion coefficient have been measured as a function of temperature on the polycrystals of the heavy rare earth metals, Gd, Tb, Dy, Ho, and Er and the binary alloys with each other. Anomalous linear compressibility was found near the magnetic transition temperature. The value of the linear compressibility at room temperature monotonically decreased with increasing average number of 4f electrons. The negative δ-type and λ-type anomalies of the thermal expansion coefficient were also found near the ferromagnetic-antiferromagnetic transition temperature and T_c or T_N, respectively. (auth)

6686 DAMPING AND ELASTIC CHARACTERISTICS INVESTIGATION OF PLASMA TUNGSTEN, NICHROME, ZIRCONIUM DIOXIDE AND CHROMONICKEL SPINEL COATINGS. Zolotukhin, I. V.; Akinin, K. L.; Abramov, V. V.; Netuzov, Yu. K.; Skorobogatov, V. S.; Svedomtsev, N. V. (Voronezhskij Politekhnicheskij Inst. (USSR)). Probl. Prochnosti; No. 9, 86-89(Sep 1973). (In Russian).

For English translation see the journal Strength Mater.

A study is made of the damping and elastic characteristics of thin plasma coatings. The effects of the deposition conditions and annealing of the coating on the value of the damping of oscillations and the elasticity modulus were shown. The temperature dependence of the absorption coefficient and the elasticity modulus of the coating was determined. (tr-auth)

6687 ELECTROPLASTIC EFFECT IN INDIUM. Troitskij, O. A.; Gusev, E. V. (AN SSSR, Moscow. Inst. Fizicheskoj Khimii). Probl. Prochnosti; No. 12, 50-53(Dec 1973). (In Russian).

For English translation see the journal Strength Mater.

It was shown that as a result of irradiation with electrons at energies above the threshold for the knock-on of atoms and as a result of the influence of non-thermal effects by currents, the rate of low-temperature creep of In crystals was increased and the critical shearing stress was decreased. It was proposed that these effects are not related to a variation of the activation space, but are caused by a decrease of the time (frequency increase) of the process of thermoactive surmounting of the barriers by the dislocations. (tr-auth)

6688 EFFECT OF THE OXYGEN ADSORPTION ON ELECTRON AND ADSORPTION PROPERTIES OF BARIUM ATOMS ON THE (100), (110) AND (111) FACES OF TUNGSTEN. Kultashev, O. K.; Makarov, A. P. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 2, 317-321(Feb 1974). (In Russian).

For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The effect of the adsorption of oxygen on the work function and the heat of adsorption of films of Ba atoms on the principal faces of W was studied. The existence of anisotropy in the electron and adsorption properties of Ba atoms during simultaneous adsorption of oxygen on W was detected. (tr-auth)

6689 CHEMICAL SHIFT IN THE AUGER SPECTRA OF TUNGSTEN AND MOLYBDENUM DURING OXYGEN ADSORPTION. Dadayan, K. A.; Kriger, Yu. G.; Tapilin, V. M.; Savchenko, V. I. (AN SSSR, Novosibirsk. Inst. Kataliza). Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 2, 273-277(Feb 1974). (In Russian).

For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The Auger spectra of pure W and Mo were studied in detail. A chemical shift in the Auger spectra was detected during adsorption of oxygen (at 300°K) and high-temperature oxidation. (tr-auth)

6690 AN EXPERIMENT AND ITS ANALYSIS ON THERMAL-STRESS RATCHETING OF A TUBULAR SPECIMEN SUBJECTED TO BOTH A STEADY INTERNAL PRESSURE AND A CYCLIC THERMAL STRESS. Uga, T. (Japan Atomic Energy Research Inst., Tokai). Nippon Kikai Gakkai Rombunshu; 39: No. 328, 3591-3599(Dec 1973). (In Japanese).

Nuclear fuel sheaths and the various tubes in heat exchangers are the representative structural elements subjected to both steady internal pressure and cyclic thermal stress. The requirement of the operation at high temperature and high power output is imposed on such heat transfer elements, so that the thermal stress inevitably increases and the steady primary stress caused by internal pressure approaches the yield strength of material. Therefore there is large probability of thermal stress ratcheting, which is considered to be one of the breakdown modes of such structural materials. In this experiment, SUS-347 tubular specimens with inner diameter of 10 cm, outer diameter of 12 cm and length of 120 cm loaded with internal pressure were directly heated, and at the same time, cooled from outside to generate thermal stress in the specimens. By the on-off switching of a heater, cyclic thermal stress was imposed to the specimens. Under this condition, based

on the temperature difference between inside and outside the specimen and the primary stress by internal pressure, circumferential one-axis ratcheting was analyzed. The ratcheting stress in primary thermal stress cycle was found to agree with theoretical value. Shakedown stress was unexpectedly larger than theoretical value. It was found that this difference was caused by the fact that the temperature in thermal stress loading was rather higher than that in unloading. (JA)

Radiation Effects

Refer also to abstracts 6855, 7613, 7618, 7619, 7621, and 7779.

6691 (AD-777744) RIP, A ONE-DIMENSIONAL MATERIAL RESPONSE CODE. Volume I. User's Guide. Final Report. Fisher, R. H.; Lane, G. A.; Cecil, R. A. (Systems, Science and Software, La Jolla, Calif. (USA)). Sep 1972. 543p. (DNA-2993S-1). NTIS $10.25.

The radiation interaction program (RIP) was developed and documented as part of the DNA-sponsored PREDIX program. RIP is a one-dimensional, slab geometry, material response code. This code is used to calculate the response of homogeneous materials exposed to X-ray radiation, electron beams, plate impact, or an arbitrary time-dependent pressure boundary condition. The report contains a description of the input required to define a calculation, a description of the output produced by RIP, and example calculations. In particular, examples of X-ray, electron beam, and plate impact calculations are included. Also included are examples of restarting calculations and alterations to the mesh on restarts. (GRA)

6692 (AD-781714) GASEOUS HELIUM CONTRACT. Doran, J. C.; Symko, O. G. (Utah Univ., Salt Lake City (USA). Dept. of Physics). 19 Jun 1974. Contract N00014-71-C-0413. 63p. NTIS $7.75.

Studies were made on defect retention in copper during electron irradiation at 80K; simulated migration and reaction of correlated point defects; paraelectric behavior of OH^- ions in alkali halides; paraelastic alignment of OH^- ions in RBBR and RBI; electromodulation spectroscopy of localized excitations in crystals; dielectric loss measurements on OH^- dipoles in KBr; magnetization of dilute Ag–Mn alloys; and ordering and absence of Kondo state. (GRA)

6693 (JAPFNR-164) IRRADIATION AND HIGH-TEMPERATURE TESTS OF ELECTRONIC COMPONENT MATERIALS. Kawaguchi, C.; Wakayama, N.; Yamada, M.; Kawakami, T.; Kakuta, T.; Toraishi, A. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan); Japan Atomic Energy Research Inst., Tokyo). Jan 1974. 65p. (PNC-N-251-73-07). Dep. NTIS (US Sales Only) $4.00.

Magnetic materials of permanent-magnet sodium flowmeter which is used as an in-core channel flowmeter for fast breeder reactors were tested and irradiated up to ~10^{19} nvt. The results of tests showed that Alnico 8 is stronger and better than Alnico 5 against neutron irradiation. Two high-temperature neutron detectors (P-7A) which are fission counters imported from United Kingdom were tested up to 400°C and one counter was irradiated up to 5×10^6 R, independently. One showed some pulsive noise generation beyond 200°C but good functions below this temperature. The other did not show any deficiencies up to 400°C and in x-ray tests. (auth)

6694 (ORNL-TM-4593) SINGLE IRRADIATION EXPERIMENT COMPARING SIX HIGH-TEMPERATURE ALLOYS AT 760°C. Harman, D. G. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 42p. NTIS $4.00.

Three Hastelloys, two stainless steels, and eight heats of Incoloy 800 differing in carbon and titanium contents were irradiated simultaneously in the ORR at 760°C and mechanically tested at the same temperature. Creep and tensile properties after a fluence of 3 to 4×10^{20} thermal and 1 to 2×10^{19} fast (>1 MeV) were compared with those of unirradiated counterparts kept in argon at 760°C for the 1100-h irradiation period. Titanium-modified Hastelloy N lost substantially less strength and ductility than the standard alloy, and Hastelloy X-280 suffered even less loss. The rupture life and ductility of titanium-modified type 304L stainless steel suffered less from irradiation than those of unmodified type 304, particularly at low strain rates. Preirradiation aging for 100 h at 800°C improved the ductility of the titanium-modified alloy but degraded that of ordinary type 304. Although unirradiated high-carbon heats of Incoloy 800 showed better rupture life and ductility than low-carbon heats, irradiation erased the difference. Although these properties were enhanced by titanium addition in the unirradiated condition, only the alloy with 0.1% Ti (not more or less) showed enhanced postirradiation properties, and these were pronounced chiefly at low stresses. Preirradiation aging had little effect on the Hastelloys and Incoloy 800. Except for the Incoloy 800 creep specimen containing 0.1% Ti, all irradiated alloys examined showed extensive intergranular fracture. Both creep and tensile testing were necessary to properly characterize effects of irradiation. (auth)

6695 (RCN-198) VOIDS IN FAST NEUTRON IRRADIATED ALUMINIUM. van Witzenburg, W.; Hamburg, G.; Elen, J. D. (Stichting Reactor Centrum Nederland, Petten). Mar 1974. 29p. Dep. NTIS (US Sales Only) $4.50.

The void concentration and volume fraction in fast neutron irradiated aluminum of different grades is determined by means of transmission electron microscopy. Fluences range up to 3.5×10^{20} n · cm^{-2} (E > 0.1 MeV). At this irradiation level the purest aluminum, containing less than 10 ppM impurities, swells 0.14% due to voids. The void concentration and volume fraction are higher and the dislocation density lower for purer grades of aluminum after irradiation. The least pure materials, with more than 1% impurities, do not contain voids at all. The observations point to a vacancy trapping mechanism (e.g. impurity atoms) operating in the less pure materials. (auth)

6696 (SLA-74-5282) FORMATION OF SUBSTITUTIONAL ALLOYS IN FCC METALS BY HIGH DOSE IMPLANTATIONS. Poate, J. M.; Borders, J. A.; DeBonte, W. J.; Augustyniak, W. M. (Sandia Labs., Albuquerque, N. Mex. (USA); Bell Labs., Murray Hill, N. J. (USA)). 1974. 8p. (CONF-740819-2). Dep. NTIS $4.00.

From 4th international conference on ion implantation into semiconductors and other materials; Osaka, Japan (26 Aug 1974).

The lattice location of Au implanted to high doses at room temperature into single crystal Ni, Cu, Pd, and Ag has been determined using ^4He ion channeling and backscattering. In all cases the Au atoms are found to be 100% substitutional for room temperature implants without annealing. Au implants in Cu at 15°K are also found to be 100% substitutional. High dose implants of W in Cu, a reportedly insoluble impurity are also found to be highly substitutional. (auth)

6697 (WARD-OX-3045-13) INTERIM RECOMMENDATIONS FOR IRRADIATION CREEP DESIGN EQUATION FOR 20% COLD WORKED TYPE 316 STAINLESS STEEL. Foster, J. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Sep 1974. Contract AT(11-1)-3045. 74p. AT.

The irradiation creep design equation for 20% cold-worked (CW) type 316 stainless steel is documented. The equation is developed by describing the theoretical mechanisms of swelling and irradiation creep and reviewing the experimental data in terms of the creep and swelling mechanisms. The deviatoric creep strain equation is presented in two parts—the strain equation and the rate equation. (JRD)

6698 SWELLING CORRELATION FOR TYPE 304 STAINLESS STEEL AT 700°F. Hofman, G. L.; Franklin, F. C. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 147-148(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6699 SWELLING IN TYPES 304 AND 316 STAINLESS STEEL IRRADIATED TO HIGH NEUTRON FLUENCES. Busboom, H. J. (General Electric Co., Sunnyvale, CA); McClellan, G. C.; Bell, W. L. Trans. Amer. Nucl. Soc.; 19: 148-149(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6700 DOSE-RATE DEPENDENCE OF IRRADIATION PARAMETERS IN NICKEL-ION-IRRADIATED NICKEL. Westmoreland, J. E.; Sprague, J. A.; Smidt, F. A. Jr.; Malmberg, P. R. Trans. Amer. Nucl. Soc.; 19: 149-150(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6701 IRRADIATION EFFECT IN SUPERCONDUCTING MAGNETS. Onishi, T. (Electrotechnical Lab., Tokyo). Denshi Gijutsu Sogo Kenkyusho Chosa Hokoku; No. 175, 1-56(Nov 1973). (In Japanese).

Recently, superconducting magnets have been applied to the high energy particle accelerators or spark chambers. The conceptual design of superconducting magnets for the controlled thermonuclear fusion reactor is being studied because there is a possibility of controlling the thermonuclear fusion reaction. The superconducting magnets used for such kinds of apparatus will suffer from the irradiation of a great deal of high energy particles such as fast neutrons, γ-rays and so on. Consequently, the superconducting current may degrade owing radiation-induced defects or the temperature rise due to the nuclear heating. Variation of H_{c2} may also take place owing to the increase in the resistivity of

superconductor itself due to the radiation-induced defects. Furthermore, phenomena which lead to a considerable reduction of the stabilized superconducting current may occur as a result of the increase in resistivity of the stabilizing metal such as Cu or Al. The influence on the critical temperature may also be expected. Experiments made with respect to the irradiation influence on various superconductors themselves and the conducting metal such as Cu or Al are introduced, and some of the above-mentioned points in question are clarified as far as possible. The irradiation effects on the critical current density, critical field, and critical temperature of the superconductors such as Nb, NbZr, NbTi, Nb_3Sn, V_3Ga, and Nb_3Al, and effects in the small superconducting magnets wound by NbZr wire are examined. The stability of a composite superconducting wire is also discussed. (JA)

6702 NEW LINE DEFECT, DISPLACED ATOMIC ROW, IN bcc LATTICES. Takeuchi, S.; Kuramoto, E. (Tokyo Univ.). Phil. Mag.; 30: No. 2, 319-324(Aug 1974).

Using interaction potentials between close-packed atomic rows, stability of a new type of line defect, a displaced atomic row, in b.c.c. lattices was studied. The results indicate that this defect possibly exists in real b.c.c. metals. The elastic strain field around the defect is quite short-range, i.e., strain decreases as r^{-4}. The energy is around $0.08\ \mu b^2$ (μ: shear modulus, b: closest atomic distance) per unit length. (auth)

6703 FERROMAGNETIC AFTER EFFECT DUE TO INTERSTITIALS IN ELECTRON IRRADIATED NICKEL. Knoell, H.; Dedek, U.; Schilling, W. (Kernforschungsanlage, Juelich GmbH, Ger.). J. Phys., F (London); 4: No. 8, 1095-1106(Aug 1974).

The magnetic after effect and the annealing of the electrical resistivity were measured simultaneously in the temperature range of stage I of electron irradiated Ni. The results show that the interstitials which become mobile in stage I are responsible for the magnetic relaxation phenomena observed in this temperature range. From a careful comparison of the magnetic relaxation times with the characteristic times observed for the resistivity annealing it can be concluded that the reorientation of (dumb-bell) interstitials during their free migration is responsible for the observed effect. The long range diffusion of interstitials into the Bloch walls as possible source for the observed effect can be ruled out. (auth)

6704 THEORY OF ELECTRON DIFFRACTION BY THE VOID LATTICE. Stoneham, A. M. (Atomic Energy Research Establishment, Harwell, Eng.). J. Phys., F (London); 4: No. 9, 1335-1343(Sep 1974).

The theory is given for the electron diffraction by the void lattice in molybdenum, recently observed by Sass and Eyre (AERE Rep. R-7358 (1973)). The results are analyzed to see if this method can give useful new information about the voids and their ordering. The predictions of the positions and intensities of the extra peaks agree with observation. However, the quantitative theory shows that void shapes cannot readily be found from the diffraction data. Nor is it easy to get accurate information about void sizes or the nature of the disorder in the void lattice, mainly because of the problems of measuring intensity profiles. The effects of the various forms of lattice disorder are discussed qualitatively. (auth)

6705 DIRECT OBSERVATION OF CHANGES IN BUBBLE DOMAIN STRUCTURE OF COBALT PRODUCED BY ION IMPLANTATION. Brown, F. A. J.; Jones, G. A.; Grant, W. A. (Univ. of Salford, Eng.). Int. J. Magn.; 5: No. 4, 371-373(Mar 1974).

Thin electropolished foils of cobalt were implanted with 40 keV H^+ ions at doses between 10^{13} and 10^{16} ions cm^{-2}. It was observed that ion implantation can change the wall structure of bubble domains; in particular Bloch lines may be removed with successively increasing doses. Resaturating the specimen after each implantation can modify this behavior. Thus resaturation after low implant doses tends to restore a distribution of bubbles characteristic of unimplanted specimens while resaturation after higher doses results in the sole formation of bubbles with Bloch lines. Possible explanations for this behavior are presented. (auth)

6706 DIFFUSION MODEL OF PLANAR CHANNELLING OF FAST CHARGED PARTICLES. Backscattered Energy Spectra and Diffusion Constant. Oshiyama, T.; Kudo, H.; Mannami, M. H. (Kyto Univ.). J. Phys. Soc. Jap.; 36: No. 4, 1107-1113(Apr 1974).

Channeling effects of 0.63 to 2.4 MeV H^+ and He^+ ions in (110) and (111) planes of germanium were studied by backscattering method. Backscattered energy spectra were measured as a function of the angle of the incident particles to the atomic planes and the results were compared with the calculations based on a model, in which the motion of the particles is described by the diffusion in the transverse momentum space. It was shown that the experimental results can be explained by this model with a constant diffusion coefficient when the incident angle is less than about 0.6 times the critical angle of channeling. The dependence of the diffusion constant on the incident particles, particle energy and the atomic plane was studied. (JA)

6707 THERMALLY STIMULATED EXO-ELECTRON EMISSION (TSEE) FROM THE GAMMA IRRADIATED ALUMINUM. Yoshida, I. (Science Univ., Tokyo); Yamamoto, K.; Nakamura, M. Jap. J. Appl. Phys.; 13: No. 4, 720(Apr 1974).

6708 USE OF ION BOMBARDMENT TO STUDY IRRADIATION DAMAGE IN ZIRCONIUM ALLOYS. Adamson, R. B. (General Electric Co., Pleasanton, CA); Bell, W. L.; Lee, D. Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 215-228 (1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Zircaloy-2 having several different microstructures, textures, and compositions has been bombarded with either 5 or 46.5 MeV nickel ions at 300 to 600°C to achieve doses ranging from 0.65 to 87.0 displacements per atom (dpa). Similar material was reactor-irradiated near 320°C to neutron fluences between 0.8 and 3.2 dpa. Transmission electron microscopy methods were used to identify and compare the nature of the defect structure produced by the ions and neutrons. For doses below 10 dpa (8×10^{21} neutrons (n)/cm^2 (E > 1 MeV)) and temperatures below 400°C, the predominant defects formed by nickel ion bombardment are black spots and loops on the order of 100 Å diameter. For these conditions the damage appears to be similar in most ways to that produced by neutron irradiation. An exception is that a diffraction contrast effect termed "corduroy" is consistently observed after neutron irradiation but generally not after ion bombardment. At temperatures above 400°C, the residual microstructure appears to depend on the rate of displacement damage. For doses above about 10 dpa and irradiation temperatures between 400 to 500°C, bombardment with 5 MeV nickel ions produces a striking alignment of defects on {0002} planes. At 600°C, no residual irradiation damage was observed. For all conditions where damage was present, some of the defects had Burgers vectors with a component parallel to the C-axis. Possible implications of the various observations are discussed. (auth)

6709 MECHANISMS OF IRRADIATION CREEP IN ZIRCONIUM-BASE ALLOYS. Dollins, C. C.; Nichols, F. A. (Westinghouse Electric Corp., West Mifflin, PA). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 229-248(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Many models have been proposed to explain and predict in-pile creep of cladding materials. The relative merits of models based on diffusion of irradiation-induced point defects are examined and applied to zirconium-base alloys. At intermediate stresses, creep is believed to be due to dislocation glide between irradiation-produced obstacles and controlled by climb over those obstacles. The two primary models to predict dislocation climb are based on (1) the alleged increased attraction dislocations have for interstitials over vacancies and (2) statistical fluctuations in the arrival rate of vacancies and interstitials produced in equal numbers. Both models are considered in detail. In addition to creep caused by edge dislocation glide and climb, creep due to preferred nucleation of dislocation loops and their subsequent growth is considered. Such creep is believed to be dominant at low stresses. (auth)

6710 IN-REACTOR CREEP OF Zr-2.5 Nb TUBES AT 570K. Ibrahim, E. F. (Chalk River Nuclear Labs., Ont.). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 249-262(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Tubular specimens of Zr-2.5 Nb, 23 mm internal diameter, have been creep tested in-reactor at 570°K. Specimens were biaxially stressed by internal pressure, with transverse stresses from 103 to 317 MPa. Two separate experiments are reported (a) U-501/2 which has specimens quenched from 1045°K; cold drawn 2, 12, or 20 percent and aged at 773°K for 24 h, and (b) U-501/3 which has specimens extruded; cold drawn 10, 23, or 33 percent and stress relieved at 673°K for 12 h. Creep curves for quenched, cold-worked, and aged specimens (U-501/2) are best fitted by linear creep rates beyond 1000 h. Increasing cold-work between quenching and aging decreases creep strength; material with 20 percent cold-work creeps at a higher rate than material with 2 percent cold-work at the same stress. Creep curves for cold-drawn and stress-relieved specimens (U-501/3) are best fitted by a time exponent of about 0.8, that is, creep strain = $A + Bt^{0.8}$ where t = time and A and B are parameters

which depend on material and stress indicating that creep rate may be decreasing with time. Creep rates increase with amount of cold work: the specimens with 33 percent cold-work creep about 40 percent faster than those with 10 percent cold-work. Increasing amounts of cold-work is, therefore, detrimental to the in-reactor creep strength of Zr–2.5 Nb either after extruding or between ($\alpha + \beta$)-quenching and aging. (auth)

6711 IN-REACTOR STRESS RELAXATION OF ZIRCONIUM ALLOYS. Causey, A. R. (Chalk River Nuclear Labs., Ont.). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 263-273 (1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

In-reactor stress-relaxation tests were done on zirconium alloys with different compositions, grain sizes, heat-treatments, cold-work, and specimen stress directions at 568 ± 5°K in a fast neutron flux (E > 1 MeV) of 2.0×10^{17} neutrons (n)/m^2s, for up to 8200 h with initial stresses up to 300 MPa. The relaxation behavior can be represented by $\sigma/\sigma_0 = D \exp(-Kt)$ where σ/σ_0 is the ratio of the unrelaxed stress at time t to the initial stress, D is a constant which approximates the stress ratio after a rapid initial drop, and K is a relaxation rate constant. The effects of the metallurgical variables on the in-reactor stress relaxation of zirconium alloys is small. Variations in composition and heat-treatments change the relaxation rate constant by factors of 2 to 4, while variations due to cold-work and working direction change the constant by factors of up to 2. Stress-relieving (or aging) following cold-work decreases the initial stress drop. (auth)

6712 HIGH DEFORMATION CREEP BEHAVIOR OF 0.6-IN.-DIAMETER ZIRCONIUM ALLOY TUBES UNDER IRRADIATION. Wood, D. S. (United Kingdom Atomic Energy Authority, Risley, Eng.). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 274-291(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

High creep strain experiments have been carried out under irradiation using cold worked Zircaloy-2, cold-worked Zr–Nb, and heat treated Zr–Nb 0.6-in.-diameter tubes in DFR, DMTR, and PLUTO reactor. The tests in PLUTO were found to be the most useful since full creep curves were obtained using neutron radiography techniques. Creep strains of up to 9 percent were obtained on cold-worked Zircaloy-2 tubes without failure, thus substantiating the recommended pressure tube creep strain limit of 3 percent. Up to 5 percent creep strain was observed with cold-worked Zr–Nb tubing, but since one tube failed at only 1.8 percent strain it is not yet possible to specify a realistic yet safe creep limit for this material. (auth)

6713 DEFORMATION OF IRRADIATED ZIRCONIUM–NIOBIUM ALLOYS. Ells, C. E. (Chalk River Nuclear Labs., Ont.). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 311-327(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The flow and fracture behavior of irradiated zirconium-niobium alloys is summarized. It is confined to the alloys currently used in power reactors, namely Zr–1.0 Nb, Zr–2.5 Nb, and Zr–2.5 Nb–0.5 Cu, and of these, most of the literature deals with the Zr–2.5 Nb alloy. Both before and after irradiation, the Zr–2.5 Nb alloy has a good combination of strength and ductility; these properties have enabled reactor designers to replace Zircaloy with Zr–2.5 Nb in applications where the superior in-reactor creep resistance of the latter alloy is important. The good ductility of the irradiated Zr–2.5 Nb alloy, however, is dependent on the alloy remaining below the beta transus in the final stages of heat-treatment/fabrication before irradiation. Although there is much information on the deformation of the irradiated material relevant to reactor design, the basic understanding of the deformation is in an early stage of development. (auth)

6714 VARIATION OF ZIRCALOY FRACTURE TOUGHNESS IN IRRADIATION. Walker, T. J. (Westinghouse Electric Corp., Pittsburgh); Kass, J. N. Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 328-354(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Irradiated and unirradiated fracture toughness data for Zircaloy-4 are summarized as functions of both temperature and orientation. Data are presented as ASTM "valid" values and as maximum or failure values which may be desirable for certain applications with multiple redundant structures. Surface fractographic characterization is included based on scanning electron microscope studies of the fracture surface and metallographic studies of sections of the crack tip region. A limited amount of crack growth data for irradiated material was obtained from the irradiated fracture specimens prior to fracture testing and has been included for general reference. (auth)

6715 STRENGTH AND DUCTILITY OF NEUTRON IRRADIATED AND TEXTURED ZIRCALOY-2. Rieger, G. F. (General Electric Co., Pleasanton, CA); Lee, D. Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 355-369(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The roles of stress state and crystallographic texture on plastic flow fracture and fracture behavior were examined for Zircaloy-2 sheet specimens irradiated to fluences of 0.7 to 1.9×10^{21} neutrons/cm^2 (E > 1 MeV) at 327°C. The extent of strengthening achieved by texture was determined by comparing the level of flow strength obtained under the plane strain loading condition to that of simple uniaxial tension, all at the test temperature of 250°C. It was demonstrated that the relative aspects of texture strengthening were retained in the post-irradiation tests; that is, the material with the peak basal pole density parallel to the sheet normal evidenced less ductility than that with the peak basal pole density inclined at 30° to the sheet normal. Supporting evidence is presented in terms of the changes in flow stress and ductility with texture and by the magnitude of R, the ratio of the transverse plastic strains. Plane strain loading increased the flow stress by 66 percent in the material having the peak basal pole density parallel to the sheet normal, but did not change the flow stress for material with the peak pole density inclined > 60° to the sheet normal. Texture strengthening persisted to the maximum fluence tested, suggesting a strong texture effect on the mechanical behavior of irradiated materials. The overall level of strain at fracture was substantially reduced by irradiation. The deformation and fracture modes were also strongly affected by texture as well as by the loading methods. The irradiated Zircaloy sheet with the peak basal pole density in the normal direction tended to deform by means of sharply defined deformation bands; intersection of these bands also leads to initiation of fracture. In the other materials (peak basal pole densities inclined to the normal by angles > 30°) the deformation bands tended to be more diffuse. (auth)

6716 PLASTIC INSTABILITY IN IRRADIATED Zr–Sn AND Zr–Nb ALLOYS. Cheadle, B. A.; Ellis, C. E.; van der Kuur, J. (Chalk River Nuclear Labs., Ont.). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 370-384(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

Factors affecting the plastic instability of irradiated zirconium alloys in tensile deformation have been studied. The materials used were pure zirconium, commercial Zircaloy-2 and Zr–2.5 Nb, and a series of alloys based on pure zirconium containing either niobium or tin. The materials were rolled into thick sheet which enabled different crystallographic textures and deformation modes to be studied. Niobium alloy additions delay the onset of plastic instability and in some circumstances reverse the textural effects found in commercial Zircaloy-2 and Zr–2.5 Nb. The merits of Zr–Nb alloys for use as fuel sheathing are outlined. (auth)

6717 IRRADIATION DAMAGE RECOVERY IN SOME ZIRCONIUM ALLOYS. Carpenter, G. J. C.; Watters, J. F. (Chalk River Nuclear Labs., Ont.). Amer. Soc. Test. Mater., Spec. Tech. Publ.; No. 551, 400-415(1974).

From symposium on zirconium in nuclear application; Portland, Oregon, USA (21 Aug 1973). See ASTM-STP-551; CONF-730822-.

The recovery of irradiation damage in a number of zirconium alloys has been studied by means of hardness measurements. The experiments were designed to examine the effect of different solutes (copper, aluminum, titanium, niobium, molybdenum) and metallurgical condition on the stability of irradiation-induced defect clusters. Sheet specimens have been irradiated at 50°C to a fast neutron fluence of 5.5×10^{19} neutrons (n)/cm^2 and the hardness changes studied during isochronal annealing. The specimens were heat treated prior to irradiation as follows: (a) well annealed, to approach the equilibrium structure and (b) β-quenched. Most of the annealed alloys recovered in one stage over a temperature range of about 100°C within the range 300 to 460°C. The behavior of the β-quenched specimens was more complicated due to the simultaneous annealing of the martensitic substructure and solute precipitation. The presence of a high supersaturation of niobium or molybdenum resulted in large hardness increments as a result of irradiation. This is believed to result from precipitation of

the solute on a fine scale or to the formation of solute/radiation damage complexes. Transmission electron microscopy under kinematical conditions revealed the presence of "black spot" images, 30 to 70Å in diameter in a concentration of $\sim 5 \times 10^{16}$/cm^3. The smallest images could not be clearly distinguished owing to the presence of a thin oxide film on the surfaces of thin foil specimens. Some possible implications of these results to the problem of in-reactor creep are discussed. (auth)

6718 ELECTRICAL PROPERTIES OF IRRADIATED GaSb. Sokolowski, D. H. St. Louis; Saint Louis Univ. (1974). 128p. University Microfilms Order No. 74-24,145.

Thesis (Ph. D.).

Single crystals of undoped gallium antimonide were irradiated with 3.2 MeV deuterons. Samples were maintained at approximately 100°K for the irradiation. Resistivity, Hall coefficient, and the Seebeck coefficient were measured as functions of temperature and deuteron flux. The temperature was varied from approximately 100°K to room temperature, and the deuteron flux varied from 1.56×10^{13}/cm^2 to 1.06×10^{16}/cm^2. Radiation induced effects were observed in resistivity and Hall coefficients for fluxes ranging from 10^{14}/cm^2 to 10^{16}/cm^2. Significant changes in the Seebeck coefficient were observed only for fluxes of approximately 10^{16}/cm^2. Resistivity and Hall coefficient were used to determine the Hall mobility. The data was best fit assuming scattering by ionized impurities and acoustical phonons. Data presented is interpreted assuming that the reciprocal mobility has a temperature dependence given by $\mu^{-1} = AT^{+\frac{1}{2}} + BT^{-\frac{1}{2}}$. This is in agreement with accepted theories. (Diss. Abstr. Int., B)

Other Materials

Refer also to abstracts 5642, 5644, 5652, 6177, 6179, 6562, 6631, and 7425.

6719 (AD-778690) RADIATION AND CHARGE TRANSPORT PHENOMENA IN IMPROVED HARDENED INSULATORS. Final Report, 12 December 1972–31 January 1974. Powell, R. J. (RCA Labs., Princeton, N. J. (USA)). 31 Jan 1974. Contract N00014-73-C-0277. 43p. (PRRL-74-CR-5). NTIS $3.25.

Previous efforts to effectively investigate and model the high-field charging phenomenon in pyrolytic Al_2O_3 have been thwarted by the difficulty of separating the injection and trapping phenomena. Characterizing the injection is extremely difficult because the interface electric field varies as charge accumulates in traps and the varying field produces rapidly varying currents, making it equally difficult to ascertain trapping behavior. In this report high-field electron injection and photoinjection into Al_2O_3 are investigated using new experimental techniques which maintain constant the interface fields and injection currents, thereby permitting independent determination of injection and trapping characteristics. Studies of field and temperature dependence provide strong evidence that the electron injection occurs by trap-assisted tunneling. Isochronal thermal annealing results are also presented, and a preliminary model for radiation-induced charging is suggested. (GRA)

6720 (AED-CONF-74-328-004) OPTICAL AND UNIAXIAL STRESS STUDIES OF IRRADIATION-INDUCED DEFECTS IN DIAMOND. Walker, J. (Reading Univ. (UK). J. J. Thomson Physical Lab.). 1974. 8p. INIS.

From international conference on lattice defects in semiconductors; Freiburg im Breisgau, F. R. Germany (22 Jul 1974).

4 figs.; 31 refs. With abstract.

Two zero-phonon lines were studied in irradiated diamond using optical absorption and uniaxial stress. TR12 (470 nm, 2.64 eV) is shown to be due to a delta oscillator at a defect of monoclinic I symmetry, and a possible model is the divacancy. 3H (503 nm, 2.46 eV) is due to a π ⟨110⟩ oscillator at a rhombic I defect, and a suggested model is the oxygen-vacancy pair. The relationship of 3H to the H3 and S1 optical systems in diamond, which also have zero-phonon lines at 503 nm, is discussed. (auth)

6721 (AED-CONF-74-328-007) LCAO-MO CALCULATIONS ON THE SELF-INTERSTITIAL AND THE FRENKEL PAIR IN TELLURIUM. Weigel, C.; Corbett, J. W.; Landwehr, G. (State Univ. of New York, Albany (USA). Dept. of Physics). 1974. 15p. INIS.

From international conference on lattice defects in semiconductors; Freiburg im Breisgau, F. R. Germany (22 Jul 1974).

5 figs.; 3 tabs.; 14 refs. With abstract.

The results of LCAO-MO cluster calculations based on the Extended Hueckel Theory for the self-interstitial and the Frenkel pair in the trigonal tellurium lattice are presented. For the interstitial, a position appears to be favored where there are four nearest neighbors located in three different chains. Deep donor levels are found for this interstitial position. The Frenkel pair can act as both donor and acceptor, but due to the positions of the occupied and unoccupied levels in the gap, it requires less energy to make a hole in the valence band than to put an electron in the conduction band. This seems to conform with the experimentally observed increase of the hole concentration in tellurium after electron-irradiation. The formation energy of the Frenkel pair is calculated to be approximately 2 eV. (auth)

6722 (AED-CONF-74-328-012) ANOMALOUS OUTDIFFUSION OF BERYLLIUM IMPLANTED INTO SILICON. Hurrle, A.; Schulz, M. (Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Freiburg im Breisgau (F. R. Germany). Inst. fuer Angewandte Festkoerperphysik). 1974. 7p. INIS.

From international conference on lattice defects in semiconductors; Freiburg in Breisgau, F. R. Germany (22 Jul 1974).

7 figs.; 9 refs. With abstract.

The depth distribution of implanted beryllium was investigated by means of secondary ion mass spectrometry (SIMS). A strong diffusion to the surface was observed after annealing at temperatures above 350°C. Almost the total implanted dose was located in a thin (100 A) surface layer after annealing at temperatures above 600°C. The observed outdiffusion occurred at lower temperatures the higher the implanted dose. Similar effects were observed for implantation in silicon samples covered by thin oxide layers. Schottky barrier CV-measurements showed the same outdiffusion. An energy level was determined for implanted beryllium, which indicated a non-thermal state of incorporation. A model is proposed which explains this behavior by the formation of Be-defect complexes. (GE)

6723 (ARL/Met.-98) STRUCTURE AND MECHANICAL PROPERTIES OF CARBON FIBRES. Coyle, R. A.; Wicks, B. J. (Aeronautical Research Labs., Melbourne (Australia)). Jan 1974. 32p. Dep. NTIS (U. S. Sales Only) $4.75.

The mechanical properties of carbon fibers that are important in determining the performance of carbon-fire-composite materials to the basic fiber structure and to the size and distribution of stress-raising flaws are examined. The extent to which structural parameters are affected by graphitizing heat-treatments is discussed and the role of these parameters in limiting the potential performance of carbon fibers is indicated. Various processing treatments (including neutron irradiation) that have been found to modify the final fiber characteristics are surveyed and the structural changes underlying these treatments are described. (auth)

6724 (GERHTR-111) PYROCARBON, AN IMPORTANT MATERIAL FOR HIGH-TEMPERATURE GAS-COOLED REACTORS. Gyarmati, E.; Koizlik, K.; Krautwasser, P.; Luhleich, H.; Nickel, H.; Schulze, H. A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe unde Heisse Zellen). Mar 1974. 16p. (JUL-1052-RW). Dep. NTIS $4.00.

Work performed under United States–German High Temperature Reactor Research Exchange Program.

The present state of pyrocarbon technique development and its application to reactor technology is summarized. The deposition methods are described as well as the methods for characterization of the pyrocarbon deposits. Latest results of structural analysis of this material are presented. Theoretical model conceptions of pyrolysis and deposition mechanism and of microphysical processes during neutron irradiation and heat treatment of pyrocarbon coated fuel particles are described, along with the experiments, on which these models are based. (auth)

6725 (JUL-1082-RW) INFLUENCE OF THE METHOD OF MEASUREMENT ON THE OPTICAL ANISOTROPY FACTOR OPTAF OF PYROCARBON. Koizlik, K.; Taeuber, K.; Nickel, H.; Wasmund, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Jul 1974. 37p. (In German). Dep. NTIS (US Sales Only) $5.00.

The development and installation of an automatic microscope photometer for the measurement of the optical anisotropy factor (OPTAF) on the pyrocarbon coatings of fuel particles are described. After a short representation of the physical basis of this procedure the new microscope photometer is introduced. First measurements for the adaptation of the new microscope photometer are discussed. By these measurements the influence of the instrument on the value of OPTAF in the case of some special ways of measuring are explained and the appearance of an apparent anisotropy is interpreted. (auth)

6726 (LBL-3138) PSEUDOPOTENTIAL AND TIGHT-BINDING CALCULATIONS OF THE BULK AND SURFACE ELECTRONIC

STRUCTURE OF SOLIDS. Chadi, D. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 5 Sep 1974. Contract W-7405-eng-48. 249p. Dep. NTIS $15.50.

Thesis.

The electronic structure of semiconductors, alloys, transition metal compounds, and the electronic states associated with surfaces are studied using the empirical pseudopotential and the tight-binding methods. Experimental data are extensively used to obtain information on the pseudopotential and tight-binding parameters, and to check the accuracy of the theoretical calculations. Reflectivity spectra, frequency dependent dielectric constants, densities of states, and charge density distributions are calculated for a number of compounds and compared to corresponding experimental information when available. A new scheme is developed which results in an appreciable increase in the accuracy of calculations that are frequently encountered in the study of periodic systems. The scheme allows the calculation of various quantities (such as charge density distributions, average energies or dipole matrix elements, etc.) from a knowledge of the values of these quantities at a few optimally chosen states. This is used to derive an expression for the electronic charge density distribution in diamond structure crystals. The method is also very useful in obtaining interpolation formulas and in the construction of localized Wannier functions from the extended Bloch functions. The method is utilized to study the charge density and also the relationships between ionicity, valence band splittings, and atomic pseudopotentials for a number of binary crystals. To study systems which do not have long range periodicity an extensive study of the use of the tight-binding method for calculating the electronic structure of diamond and zincblende crystals is made. The method is used to investigate the surface states of these types of crystals. The effects of surface relaxation on the local density of surface atoms, the localization and the character of the various surface states are discussed. (auth)

6727 (RISO-308) DYNAMICS OF LIQUID HYDROGEN AND LIQUID NITROGEN STUDIED BY INELASTIC NEUTRON SCATTERING. da Costa Carneiro, K. (Danish Atomic Energy Commission, Risoe. Research Establishment). May 1974. 54p. Dep. NTIS (US Sales Only) $5.75.

Thesis. Submitted to Univ. of Copenhagen.

The assumption for the ideal phonon theory used to describe lattice dynamics is analysed, and noncrystalline materials are classified according to which assumptions are obeyed and which are violated. Neutron scattering results from liquid H_2 are critically analysed with the result that the concept of phonons must be introduced to understand this liquid, and consequently the phonons are quantitatively discussed. In liquid N_2, no evidence of phonons is seen in the neutron scattering pattern, in agreement with results for liquid Ar. The influence of the rotational degrees of freedom in liquid N_2 is briefly discussed. Results presented together with similar results for the liquids Ar, He, and Rb support the classification and indicate how further understanding of the dynamics of liquids may be gained. The use of a neutron triple-axis crystal spectrometer in the study of liquids is also discussed. (20 fig, 45 references) (auth)

6728 (RLO-2221-T6-1) SPECTROSCOPIC STUDIES OF ACTINIDE IONS IN CRYSTALLINE SOLIDS. Progress Report, October 1, 1970–September 30, 1971. Gruber, J. B. (Washington State Univ., Pullman (USA)). 1971. Contract AT(45-1)-2221. 271p. Dep. NTIS $16.75.

Studies were made on the interpretation of the optical and magnetic properties of actinide and rare earth ions in solids. The low-temperature semiconducting and superconducting properties of rare earth and impregnated uranium sulfide and carbide, the hydrated sulfate phonon maser, and the high-temperature electrical properties of uranium oxides and sulfides as thermoelectric devices represent a few of the ideas that may emerge from the detailed fundamental studies underway. (SFL)

6729 PHYSICO-CHEMICAL PROPERTIES OF LANTHANUM, CERIUM, AND PRASEODYMIUM CYCLOTRIPHOSPHATES $LnP_3O_9 \cdot 3H_2O$, AND THEIR TRANSFORMATION TO MONOPHOSPHATE $LnPO_4$. Simonot-Grange, M. H.; Gobled, D. (Faculte des Sciences, Dijon, France). J. Less-Common Metals; 38: No. 2/3, 167-176(1974).

Under ambient pressure and temperature conditions lanthanum, cerium, and praseodymium cyclotriphosphates, $LnP_3O_9 \cdot 3H_2O$, are transformed spontaneously into the monophosphate, $LnPO_4$, after a period of 6 months to 1 year. These rare-earth cyclotriphosphates are metastable within a limited region of water pressure and temperature. Outside this region the monophosphate is the stable form. A P,T diagram defines these different regions. (auth)

6730 OPTICAL SPECTRA PRODUCED IN NEON AND ARGON MIXTURES BY IONIZING RADIATION. Thiess, P. E.; Miley, G. H. (Univ. of Illinois, Urbana). Trans. Amer. Nucl. Soc.; 19: 64-66(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6731 SURFACE DAMAGE OF SILICON BY HEAVY IONS. Pritchard, W. M. (Old Dominion Univ., Norfolk, VA). Trans. Amer. Nucl. Soc.; 19: 66-67(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6732 METHODS OF STUDYING THE RUPTURE OF CARBONS AND GRAPHITES. Schill, R. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 192, 63-70(May 1974). (In French).

Some of the methods used for a better understanding of the fracture behavior of carbon materials are reported. Optical examination by microscopy or cinematography bring out the mechanisms connected with granular texture and porosity, which control crack propagation. Splitting tests or diametral compression tests on graphite rings and tubes show the material accomodation to large strains in heterogeneous stress fields. Furthermore, stress calculations founded on conventional theories cannot apply to carbon materials. A similar conclusion may be inferred from biaxial loading experiments, particularly when the stresses are both compressive. Although it appears to be rather approximate to use for graphites the linear elastic fracture mechanics, the measurements of the stress intensity factors and the crack propagation energies point out to the effects of anisotropy and texture. It is desirable to standardize the experimental procedures and to design the suitable testing techniques for carbon materials. (FR)

6733 RUPTURE OF CARBON MATERIALS. Jouquet, G. (CEN de Saclay, Gif-sur-Yvette, France). Bull. Inform. Sci. Tech. (Paris); No. 192, 25-38(May 1974). (In French).

The mechanical behavior of artificial carbons and graphites is markedly influenced by their manufacture processes. It can be shown how structure, granular texture, and porosity played part in the fracture phenomena. The various mechanisms can be qualitatively described, which induce crack build up and propagation. In the present state of work, it is not still possible to introduce them in a theoretical prediction fitting neither the fracture toughness of these materials nor their actual failure criteria. (FR)

6734 POSSIBLE SEMICONDUCTING AND SUPERCONDUCTING PHASES IN HEXABORIDE ALLOYS. Hulliger, F. (Eidgenoessische Technische Hochschule, Zurich). Solid State Commun.; 15: No. 5, 933-936(1 Sep 1974).

Based on the fact that hexaborides exist within a certain range of valence-electron concentration, possible solid solutions are proposed that allow a wide variation of physical parameters. Phases of the type $Lu^{3+}_{0.67}B_6$ and $Na_{0.5}Lu^{3+}_{0.5}B_6$ should be magnetic semiconductors. (auth)

6735 EFFECTS OF HEATING ON COLOR CENTERS IN GERMANIUM-DOPED QUARTZ. Anderson, J. H. (Univ. of Pittsburgh); Feigl, F. J.; Schlesinger, M. J. Phys. Chem. Solids; 35: No. 10, 1425-1428(Oct 1974).

Optical absorption, electron paramagnetic resonance absorption, and thermoluminescence were measured in germanium-doped quartz crystals which were X-irradiated at room temperature and subsequently heated. Strong bleaching of the 280 nm optical absorption and the A and C center magnetic resonance absorptions coincided with maxima of the total thermoluminescent glow curve. The temperature at which these several phenomena occurred varied for different quartz samples. (auth)

6736 PREDICTION OF THE APEX ANGLE OF SURFACE CONES ON ION-BOMBARDED CRYSTALLINE MATERIALS. Whitcomb, M. J. (Univ. of the Witwatersrand, Johannesburg). J. Mater. Sci.; 9: No. 8, 1227-1232(Aug 1974).

Different methods of calculation based on ion channelling in a target matrix were applied to the computation of the apex angle of surface conical shapes derived from ion bombardment. Comparison with values obtained experimentally be electron microscopy and deduced from sputter yield curves in the energy range 0.2 to 27.0 keV indicate that reasonable agreement can be achieved using a smeared Thomas Fermi atomic plane potential. (auth)

6737 ALUMINIUM AND GALLIUM IMPURITY EFFECTS ON THE PHOTOLUMINESCENCE FROM ELECTRON IRRADIATED, PULLED SILICON. Noonan, J. R.; Kirkpatrick, C. G.; Streetman, B. G. (Univ. of Illinois, Urbana). Solid State Commun.; 15: No. 6, 1055-1059(15 Sep 1974).

The commonly observed 0.970 eV peak in the low-temperature photoluminescence from electron-irradiated Si is strongly suppressed in Ga-doped material. Another important peak at 0.790

eV is inhibited by Al doping. The present results are in conflict with previous identification of the defect responsible for the 0.790 eV peak. New luminescent bands observed only in samples with Al and Ga doping are reported. (auth)

6738 MICROSCOPIC STUDIES OF OXIDIZED HIGHLY ORIENTED PYROLYTIC GRAPHITES. Rodriguez-Reinoso, R.; Thrower, P. A. (Pennsylvania State Univ., University Park). Carbon; 12: No. 3, 269-279(Jun 1974).

Microscopic examination of two highly oriented pyrolytic graphites reacted with oxygen has revealed some unusual structural features. Oxygen attack occurs on basal plane surfaces to produce channels at crystallite boundaries, monolayer pits at lattice vacancies, and deeper pits at some unidentified structural defects. It is argued that these defects are not non-basal screw dislocations but may be associated with some structural irregularity which occurred during deposition. The depth of these pits (~10μm) is much larger than the crystallite dimension. L_c (~500Å). At the edge surfaces, where most of the oxidation occurs, preferential attack is evident from channels which appear to follow random paths into the material up to 120 μm long. These are suggestive of catalytic attack but no catalyst particles have ever been observed. On some edge surfaces a blocky structure is observed which may be related to terraces in the basal plane pits. These observations indicate the presence of a structural macrounit containing several crystallites, highly oriented but separated by basal plane twist boundaries. (auth)

6739 RELATIONSHIP BETWEEN CRYSTAL STRUCTURE AND PROPERTIES AND IRRADIATION BEHAVIOR OF REACTOR GRAPHITES. Engle, G. B. (Gulf General Atomic Co., San Diego, CA). Carbon; 12: No. 3, 291-306(Jun 1974).

Nineteen graphites manufactured with a wide variety of raw materials and processes were characterized and correlations sought between structure and properties. The raw materials of the graphites ranged from highly isotropic cokes to anisotropic needle cokes and processing from conventional molding and extrusion to proprietary processes that produce high-strength isotropic materials. Strength, thermal expansivity, and the degree of anisotropy were found to correlate with crystallite size. The materials with relatively large mean apparent crystallite sizes $\bar{L}_c$ were anisotropic and weak and had low thermal expansivity values, whereas those with smaller $\bar{L}_c$ values were isotropic and strong and had large thermal expansivities. The graphites were irradiated at 625-1625°C to fluences of up to $2 \times 10^{22} n/cm^2$. The only strong correlation found was between preirradiation strength and dimensional and volumetric changes. High-strength isotropic graphites with intermediate $\bar{L}_c$ values were most stable with lowest initial contraction rates and lowest expansion rates after turnaround. Low-strength isotropic graphites were in the same range of stability with low-strength anisotropic graphites, except distortion was minimized due to their isotropic dimensional changes. (auth)

6740 RELATION BETWEEN ANISOTROPY RATIO OF THERMAL EXPANSION COEFFICIENT AND BACON ANISOTROPY FACTOR. Matsuo, H.; Sasaki, Y. Carbon; 12: No. 3, 351-352 (Jun 1974).

Thermal expansion coefficients, between RT and 100°C, were measured on nuclear graphites made of needle coke and Gilsonite coke filler material, with specimens cut both parallel and perpendicular to the direction of extrusion or moulding. Bacon Anisotropy Factor and apparent crystallite size Lc(002) were obtained by X-ray. Relationships between the anistropy ratio of thermal expansion coefficient at 400°C $(\alpha/\alpha)_{400}$, Bacon Anisotropy Factor, and apparent crystallite size L_c were shown graphically. The results indicated that relaxation of the expansion of crystallites occurs partly within the grains. The bulk anisotropy of the thermal expansion coefficient depends largely upon the characteristics of grains, such as apparent crystallite size and micropores or cracks surrounding the crystallites. (UK)

6741 EXCHANGE NARROWING OF THE DIPOLAR FIELDS IN EuX(X = O, S, Se, Te, B_6) FROM ESR AT 70 GHz. Sperlich, G.; Hansen, K. (Technische Univ., Darmstadt, Ger.). Solid State Commun.; 15: No. 6, 1105-1109(15 Sep 1974).

The exchange narrowed ESR linewidth is expected to become frequency dependent if the resonance frequency and the reciprocal correlation time of the local dipolar fields are in the same order of magnitude. A report is presented on a corresponding ESR linewidth investigation of the four Eu-monochalcogenides and of EuB_6 which were performed up to 70 GHz. (auth)

6742 OXIDATION OF GRAPHITE. Zone 2 Omission. Wallouch, R. W.; Heintz, E. A. (Speer Carbon Co., Niagara Falls, NY). Carbon; 12: No. 3, 243-248(Jun 1974).

The effect of a boron-phosphorus-silicon oxidation inhibitor on the gas phase oxidation of graphite was studied using different graphites. It was noted, by the determination of activation energies, that the zone II response was absent when the particular inhibitor employed was present. The absence of the diffusion controlled zone II range is believed to be due to an effective plugging of the pores of the graphite. (auth)

6743 LOW-LYING ELECTRONIC STATES OF ScH. Scott, P. R.; Richards, W. G. (Oxford Univ.). J. Phys., B (London); 7: No. 13, 1679-1682(11 Sep 1974).

Approximate Hartree-Fock wave functions are obtained for the ground and low-lying states of ScH, whose internuclear separations and vibrational frequencies are predicted. Correlation energy differences are estimated from atomic data, and two states are found to be extremely low-lying, $^3\Delta$ and $^1\Sigma^+$. The dissociation energy of the molecule is predicted to be approximately 1.8 eV. (auth)

6744 SIMPLE THEORY OF THE ELECTRON-PHONON MASS ENHANCEMENT IN TRANSITION METAL COMPOUNDS. Gomersall, I. R.; Gyorffy, B. L. (Univ. of Bristol, Eng.). J. Phys., F (London); 4: No. 8, 1204-1221(Aug 1974).

The problem of calculating the electron-phonon mass enhancement factor, λ, in transition metal compounds is discussed and a simple expression for λ is presented. NbN and NbC are treated in detail, using the results of band structure calculations. The calculation, which estimates λ from first principles without the use of adjustable parameters, gives good quantitative agreement with λ obtained from measurements of the superconducting transition temperature, T_c. The physical interpretation of the calculation is that, in both the nitride and the carbide, the light atoms scatter electrons strongly at the Fermi energy due to a p resonance, and cause T_c to be higher than in pure Nb. (auth)

6745 FIELD EXCITED PHOSPHORESCENCE IN X-IRRADIATED POTASSIUM HALIDE CRYSTALS. Paracchini, C. (Univ., Parma, Italy). Solid State Commun.; 15: No. 4, 741-745 (15 Aug 1974).

Light emission is observed at room temperature from X-irradiated KCl, KBr, and KI samples placed between insulated electrodes under high voltage excitation. The slow response of the effect to the electric field shows that metastable states are involved in the recombination process. The study of the brightness waves and the dependence of the light intensity on the temperature demonstrate that the excitation of the luminescence centers is obtained through a field assisted thermal ionization process. (auth)

6746 ENHANCEMENT OF THE SUPERCONDUCTING TRANSITION TEMPERATURE NEAR A PHASE INSTABILITY IN Na_xWO_3. Shanks, H. R. (Ames Lab., Iowa). Solid State Commun.; 15: No. 4, 753-756(15 Aug 1974).

The superconducting transition temperature of tetragonal I sodium tungsten bronze (Na_xWO_3) was found to increase rapidly as the x-value is decreased to the metal-semiconductor phase transition. It is suggested that a soft mode instability is responsible for the increased electron-phonon interaction near the phase transition. (auth)

6747 DIFFRACTION CONTRAST STUDY OF THE DEFECT STRUCTURE OF POLYETHYLENE SINGLE CRYSTALS. Thomas, E. L.; Sass, S. L.; Kramer, E. J. (Cornell Univ., Ithaca, NY). Phil. Mag.; 30: No. 2, 335-349(Aug 1974).

Dark-field electron microscopy was used to characterize the defects present in polyethylene single crystals. The effect of radiation damage on dark-field images was examined, and the optimum working conditions for employing an image intensifier to observe nearly undamaged crystals were determined. Two new defects associated with microsectors, jogs and screw dislocation dipoles at the termination of microsectors, are shown to be present. Some previously reported contrast observations of slip traces are re-examined in terms of the results. (auth)

6748 EFFECTS OF GAMMA RAY IRRADIATION ON ARC RESISTANCE OF EPOXY RESIN. Ikejiri, T. (Fukui Univ., Japan). Fukui Daigaku Kogakubu Kenkyu Hokoku; 22: No. 1, 7-19(Mar 1974).

The effects of γ ray irradiation on the electrical properties of epoxy resin were investigated. Especially, the arc resistances which are important in structural materials of electrical apparatus in which arcs may occur are discussed. ASTM D495-61 standard method was applied as the test method. Bisphenol A type, epoxy novolac type, and cycloaliphatic type resins were chosen for test. Radiation dose was $10^6 \sim 10^9$ γ at room temperature and in atmospheric air. Main results obtained are as follows: (1) In cycloaliphatic type epoxy resins, favorable properties are usually found.; (2) In using aromatic amine type and acid anhydrous type curing agent, favorable properties are observed to about 10^8 γ radiation dose also and the decrease of arc resistances is marked

in the resin treated with aliphatic type curing agent and catalyst; (3) The amount of curing agent for maximum or minimum arc resistance under irradiation differs from the amount required for the maximum or the minimum when irradiation is not involved; and (4) In general, loading with secondary materials controls the extent of the radiation dose dependence of arc resistance at high doses except in complete loading with fillers. (JA)

6749 METHOD FOR IMPREGNATION OF GRAPHITE. Tully, G. R. Jr.; Christensen, L. D. (to United States Atomic Energy Commission). US Patent 3,844,972. 29 Oct 1974. Filed Date 24 Oct 1958. 14p.

A method for impregnation of graphite with uranyl nitrate dihydrate in tertiary butyl alcohol solution is described. (Official Gazette)

6750 ISOTHERMAL ANNEALING OF ELECTRON-IRRADIATED CdS IN STAGE II_N. Kitagawa, M.; Yoshida, T.; Shono, Y. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 41-43(1973).

Isothermal annealing of radiation-induced change in electrical resistivity of CdS crystals has been made in the temperature range of annealing stage II_N. The electrical resistivity of high-pure and low-resistivity CdS single crystals was increased by 10-MeV electron irradiation near liquid nitrogen temperature. Measurements of the resistivity were made at 77°K after isothermal annealing at temperatures of 185 or 200°K. Analysis of the annealing curves gives an activation energy of 0.47 ~0.65 eV for acceptor-type defects in stage II_N. (auth)

6751 EXPERIMENTAL RESULTS OF THERMALLY STIMULATED CURRENT AND THERMOLUMINESCENCE MEASUREMENTS MADE ON ELECTRON-IRRADIATED AND HEAT-TREATED ZnS. Shono, Y.; Yoshida, T.; Oka, T. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 37-40(1973).

Experimental results of measurements of thermally stimulated current (TSC) for ZnS samples irradiated at liquid nitrogen temperature with 300-keV electrons (E1), at 0°C with 300-keV electrons (E2), at 0°C with 100-keV electrons (E3), or at 0°C with 200-keV electrons (S), and Zn-excess sample (E-Zn), and also the results of measurements of thermoluminescence (TL) for E1 and E-Zn are reported. In TSC measurements the following peaks were observed: 143°K, 167-173°K (A), 178-187°K (B), and 192-205°K (C) peaks for E1, 120°K, A, B, and C peaks for E2, 145°K, A, and B peaks for E3, A, B, and C peaks for S sample, and 143°K and B peaks for E-Zn. In TL measurements the following peaks were observed: 113°K, 115°K, 173°K, and 202°K peaks for E1 and 114°K and 170°K peaks for E-Zn. The 113°K TL peak corresponds to the 120°K TSC peak for E1 and the 170°K TL peak to the 178°K TSC peak for E-Zn. (auth)

6752 SYNTHESIS AND INVESTIGATION OF ZIRCONIUM TETRABORATE. Afanas'ev, Yu. A.; Ryabinin, A. I.; Eremin, V. P. (Kubanskij Gosudarstvennyj Univ., Krasnodar (USSR); Gosudarstvennyj Okeanograficheskij Inst., Sevastopol'skoe Otdelenie (Ukrainian SSR)). Dokl. Akad. Nauk SSSR; 215: No. 1, 97-100(Mar 1974). (In Russian).

For English translation see the journal Dokl. Chem.

The existence of a new inorganic compound, a zirconium borate, was shown. A chemical analysis of the synthesized material was made. The chemical composition of the compound, its ir spectra, and diffractograms were reported. A thermal analysis was also made of the substance. The totality of the data assembled indicated that the material synthesized is a zirconium tetraborate with the molecular formula $ZrOB_4O_7 \cdot 4H_2O$. (tr-auth)

6753 DEFECT CREATION IN ELECTRONIC MATERIALS. Cheng, L. J.; Corbett, J. W. (State Univ. of New York, Albany). Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1208-1214 (Sep 1974).

The status of understanding of defect creation in electronic materials, primarily semiconductors, is reviewed. Included are a survey of threshold values and a discussion of the various parameters on which the energy dependence of damage production depends. The subjects of subthreshold damage and ionization-produced damage are also discussed. (134 references) (auth)

6754 RADIATION-INDUCED IONIZATION EFFECTS IN SOLIDS: A REVIEW OF RESEARCH PROBLEMS. Holmes-Siedle, A. G. Proc. IEEE (Inst. Elec. Electron. Eng.); 62: No. 9, 1196-1207(Sep 1974).

From IEEE annual conference on nuclear and space radiation effects; Durham, NH (Jul 1971).

A brief survey of ionization effects in devices is given, with a special attention to important research problems. This paper is intended not only to indicate the interrelationships between papers presented at the IEEE Annual Conferences on Nuclear and Space Radiation Effects from 1966 to 1973, but also to indicate the gaps left and the future possibilities for work. The environments causing problems are listed, the materials and devices involved are tabulated as a matrix, and the key problems of the present and future are singled out for special attention. (58 references) (auth)

6755 THERMOLUMINESCENT SUPRALINEAR RESPONSE AS AN OPTICAL EMISSION EFFECT FOR CaF_2 V_k-CENTERS. Podgorsak, E. B.; Fuller, G. E.; Moran, P. R. (Univ. of Wisconsin, Madison). Radiat. Res.; 59: No. 2, 446-452(Aug 1974).

A three-fold correlation study of electron spin resonance (ESR), thermally activated polarization (TAP), and thermoluminescence (TL) has been performed in high purity CaF_2. All effects observed in the 140-170°K range are due to self-diffusion of the CaF_2 V_k-center. Since neither the ESR nor the TAP radiation response is supralinear, the TL supralinearity arises from an exposure-dependent optical emission factor. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Accountability and Safeguards

Refer also to abstracts 5575, 6020, and 7437.

6756 (LA-5773-MS) ELECTRONIC MODULES DEVELOPED FOR A GAMMA-RAY BARREL-SCANNING SYSTEM. East, L. V.; Stephens, M. M.; Swansen, J. E. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 4p. Dep. NTIS $4.00.

Electronic modules consisting of scintillation counter preamplifiers, buffer amplifiers, and a multi-input single-channel pulse-height analyzer are described. These modules were developed for use with an eight-channel NaI(Tl) scanning system for barrels containing plutonium-contaminated waste. (auth)

6757 SAFEGUARDS: AN ASSESSMENT. Powers, J. A. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 213(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6758 SAFEGUARDS IN TRANSPORTATION. Boyd, G. F. (Tri-State Motor Transit Co., Joplin, MO). Trans. Amer. Nucl. Soc.; 19: 213-214(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6759 APPLICATION OF TECHNOLOGY FOR SAFEGUARDING SPECIAL NUCLEAR MATERIALS. Bartels, W. C. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 214-215(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6760 SAFEGUARDS CONCEPTUAL DESIGN CRITERIA. Marcuse, W. (Brookhaven National Lab., Upton, NY). Trans. Amer. Nucl. Soc.; 19: 215(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6761 SAFEGUARDS IN REPROCESSING. Ayers, A. L.; Crawford, J. M. (Allied-General Nuclear Services, Barnwell, SC). Trans. Amer. Nucl. Soc.; 19: 215-216(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6762 PROPOSED NONDESTRUCTIVE ASSAY INSTRUMENTATION FOR THE LMFBR FUEL REPROCESSING PLANTS. Shahrokhi, F. (Univ. of Tennessee, Knoxville); Robinson, J. C.; Mihalczo, J. T.; Ackermann, N. J. Jr. Trans. Amer. Nucl. Soc.; 19: 216-217(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6763 INDUSTRIAL AND SAFETY EXPERIENCE WITH PLUTONIUM AT GENERAL ELECTRIC'S VALLECITOS NUCLEAR CENTER. Kurtz, E. F. (General Electric Co., San Jose, CA); Wallis, L. R. Trans. Amer. Nucl. Soc.; 19: 229(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6764 PERFORMANCE OF SELECTED NONDESTRUCTIVE ASSAY TECHNIQUES ON LWR $(Pu,U)O_2$ AND UO_2 FUEL. Bishop, D. M. (General Electric Co., San Jose, CA); Menzel, J. H.; Parker, J. L.; Reilly, T. D. Trans. Amer. Nucl. Soc.; 19: 303-304(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6765 NONDESTRUCTIVE ASSAY MEASUREMENTS IN AN LWR FUEL RECOVERY PLANT. Bishop, D. M.; Hall, N. E. (General Electric Co., San Jose, CA). Trans. Amer. Nucl. Soc.; 19: 304-305(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6766 COPING WITH SABOTAGE AND DIVERSION AT NUCLEAR FACILITIES. Clark, R. G. (Battelle-Northwest Labs., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 433-434(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6767 PROPOSED SAFEGUARD MEASURES TO ASSURE AGAINST NUCLEAR THEFT OR SABOTAGE. Taylor, R. B. Aware; No. 47, 3-7(Aug 1974).

The necessity of safeguarding fissile and radioactive materials is stressed. New and more elaborate methods are proposed, e.g., locating fuel fabrication and reprocessing plants next to reactors to eliminate the shipping of nuclear materials, and the establishment of a federally operated nuclear materials accounting and protection system. This system could be funded from taxes on nuclear power. Physical protection devices necessary for safeguarding nuclear materials are also discussed. (TFD)

Disposal and Storage

Refer also to abstracts 5697 and 5699.

6768 (AAEC/E-326) TRANSMUTATION OF RADIOACTIVE REACTOR WASTE. Harries, J. R. (Australian Atomic Energy Commission Research Establishment, Lucas Heights). Sep 1974. 20p. Dep. NTIS (US Sales Only) $4.00.

The feasibility of transmuting the hazardous long-lived radioactive isotopes present in reactor waste to stable or short-lived isotopes is examined. Even to transmute only the most hazardous fission product isotopes, cesium-137 and strontium-90, by protons, electrons or gamma rays requires more electrical energy than the reactor can produce. Neutron transmutation of these fission products would require high neutron fluxes such as might be obtainable from a controlled thermonuclear reactor or a spallation target. The development of both systems is many years in the future, and the spallation system would use almost all of the reactor power output. The neutron transmutation of the transuranic component of the waste is feasible by recycling in nuclear reactors. The transmutation occurs by neutron absorption and fission, so that the waste is converted to a smaller quantity of less hazardous fission product and the fission energy is utilized. (auth)

6769 (ARH-1986) SAFETY ANALYSIS REPORT: WASTE ENCAPSULATION AND STORAGE FACILITIES. Braden, D. E.; Foster, C. B.; Houston, J. R.; Kiel, G. R.; Watrous, R. A.; Zinsli, R. A. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 1 Dec 1971. Contract AT(45-1)-2130. 355p. Dep. NTIS $20.75.

The Waste Encapsulation and Storage Facilities (WESF) will provide the capability for purification of ^{90}Sr and ^{137}Cs, and their conversion to a stable solid form; encapsulation of the solidified material; and storage of the S_r and C_s capsules. The safety analysis of the WESF reveals no credible incident which would create a significant hazard for workers or the general public. Postulated incidents that were examined include fire; hydrogen explosion; vessel coil failure; loss of cooling water; loss of electrical power; encapsulation problems; capsule failure; process solution backflow; earthquakes; and wind loadings. (TFD)

6770 (ARH-SA-189) RETRIEVABLE SURFACE STORAGE FACILITY. A Facility for the Storage of Commercial High-Level Nuclear Waste. LaRiviere, J. R. (Atlantic Richfield Hanford Co., Richland, Wash. (USA)). 1974. 17p. (CONF-741028-1). Dep. NTIS $4.00.

From 22nd conference on remote systems technology; Washington, District of Columbia, USA (27 Oct 1974).

The design and operation of the Sealed Storage Cask Concept (SSCC) for interim storage of radioactive wastes are described. (TFD)

6771 (BNWL-B-376) HEAT TRANSFER IN DESIGN OF ALPHA WASTE STORAGE FACILITIES. Jansen, G. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1974. Contract AT(45-1)-1830. 33p. Dep. NTIS $4.75.

Heat transfer design calculations have been made for a conceptual alpha waste storage facility. Stacks of containers 6 ft by 4 ft by 6 ft high would be placed in a large room with natural dissipation of heat or forced air cooling. The stacks of barrels would be cooled by natural convection flow through vertical channels formed by the 3-in. radii on the corners of the containers and through 4-in. horizontal gaps between cans. The containers would be filled with plutonium-bearing wastes. A BASIC language computer program ALPHA was developed for estimating temperatures in the alpha waste storage facility. Tentative conclusions arrived at in the study were: (1) the maximum heat generation rate in the plutonium was 0.0174 W/g at 50 y with a decrease to 0.0087 W/g at 500 y because of ^{241}Am growth and

decay; (2) stacks up to 10 cans high are permissible; (3) spaces about an inch wide would have to be maintained between the cans to keep the waste cool enough; and (4) even if the walls of the building were 1-ft-thick concrete, there would be enough heat loss so that forced convection would not be needed. (auth)

6772 (JAPE-ARHCO-02) PHASE I SEISMIC REVIEW: 241-A-FARM WASTE STORAGE TANK VENTILATION SYSTEM AT HANFORD, WASHINGTON. (Blume (John A.) and Associates, Engineers, San Francisco, Calif. (USA)). Jul 1971. 35p. Dep. NTIS $4.75.

For Atlantic Richfield Hanford Co., Richland, WA.

Results of an initial seismic review of the 241-A-Farm waste tank ventilation system components are presented. The 241-A-Farm facilities are located in the 200 East area of the Hanford Atomic Energy Reservation near Richland, Washington. Underground tanks are used for the storage of liquid radioactive waste materials generated by reactor facilities in the Hanford Reservation. The 241-A-Farm ventilation system consists basically of a series of underground vent pipe networks that carry the contaminated waste tank vapors through de-entraining and condensing processes. The condensate from the waste tank vapors is piped to a shielded underground storage tank, and the condenser vent gasses are further de-entrained, filtered and exhausted. Support facilities include cooling water and emergency power supply systems. The primary components of the 241-A-Farm waste tank ventilation system are: (1) underground vapor header line networks from the 241-A, AX, AY, and AZ waste tank farms; (2) de-entrainers No. 1 and No. 2, and shielding fill containment shell; (3) surface condensers located in condenser building 241-A-401, and appurtenant main piping in the hot-pipe and operating galleries; (4) condensate storage tank 241-A-417 and appurtenant condensate piping; (5) heater, ducts, filters, exhaust fans and stack, and concrete partition wall in filter building 241-A-702; (6) emergency cooling water piping, sumps, and cooling tower; (7) the 750,000 gal. cooling water storage tank 241-A-201 and appurtenant piping; (8) compressors, emergency diesel generators, and equipment located in compressor building 241-A-701; and (9) main power transformers and switchgear. An area plan showing the general location of the ventilation system primary components is provided. (auth)

6773 (LA-5762-PR) TRANSURANIC SOLID WASTE MANAGEMENT RESEARCH PROGRAMS. Quarterly Report, April–June 1974. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 21p. Dep. NTIS $4.00.

Progress is reported on three transuranic solid waste management research programs funded by the AEC Division of Waste Management and Transportation. Corrosion of mild steel drums and the effectiveness of potential corrosion inhibitors are undergoing continued investigation in a variety of humid environs. One 11-year-old waste container was opened and examined. Exterior corrosion was negligible but substantial interior corrosion had resulted from acid residues in the contained waste materials. Interesting results were obtained from radiolysis studies; total pressurization rate from radiolytic gases appears to diminish as the total absolute pressure increases. Almost no Cl or HCl was detected in gas samples from radiolysis or chlorinated plastics. The reasons for these phenomena are being investigated. The Facility Design Criteria Report for the waste treatment development facility has been published and an architect-engineer selected for Title I design work. An incinerator was selected and ordered for prefacility testing with nonradioactive materials; it is anticipated that the same type of incinerator will ultimately be installed in the facility. A generalized structure for the environmental risk analysis has been defined so as to facilitate its application to disposal sites at LASL and elsewhere. The analytical methods allow for any degree of refinement, from rough approximations to quantitative detail; the methods also are adaptable to manual as well as computerized calculations. A variety of computer codes are being incorporated into the risk analysis to account for various transport mechanisms and distribution parameters. Atmospheric transport and inhalation dose codes are nearly complete; substantial work is still required on the hydrologic and biologic transport and the ingestion dose code. (auth)

6774 (ORNL-tr-2846) CALCULATIONS OF UNDERGROUND DEPOSITORIES OF LIQUID RADIOACTIVE WASTES. Kostin, P. P. 1972. Translated from Russian. (CONF-7210129-1). 10p. Dep. NTIS $4.00.

From science-technical conference; Kolobzheg, Poland (2 Oct 1972).

Preliminary calculations for the selection of the type and layout of the subsurface depository of liquid radioactive wastes, and also for the determination of the size of the radiation area, are performed by application of analytical methods on the basis of averaged hydrogeological parameters of the depository layer. In this, it is assumed that the radionuclides and other toxic compounds present by the wastes (dissolved phase) in an amount exceeding the permissible concentrations, migrate simultaneously with the liquid phase. Auxiliary diagrams are extensively used for a comparison of the typical designs of subsurface depositories. In a detailed design study, the parameters of the underground depository are made more accurate by computer simulation and with consideration of the actual conditions and filtration differences of the collecting layer. On the basis of the results of special laboratory and field experiments, the characteristics of the process of mass transport are determined for specific conditions, and appropriate adjusting corrections are introduced into the results of model studies. The calculations are performed with the application of digital and analog computers on the basis of specific indexes obtained experimentally. (auth)

6775 (ORNL-tr-2860) POSSIBILITIES OF DISPOSAL OF LIQUID RADIOACTIVE WASTES INTO DEEP LAYERS BELOW EARTH'S SURFACE IN THE GERMAN DEMOCRATIC REPUBLIC. Adam, K.; Koerner, W.; Richter, D. 1972. Translated from pp 11-22 of Proceedings of Science-Technical Conference Held in Kolobzheg, Poland, October 2–7, 1972. Vol. 2. 14p. Dep. NTIS $4.00.

Starting from the geological conditions in the German Democratic Republic, the disposal of low- and medium-active liquid wastes into deep geological formations is examined and compared with experiences in the application of analogous methods of disposal of conventional waste effluents. The disposal of liquid radioactive wastes in depleted mines and also in old crude oil and natural gas deposits is discussed as an appropriate method; and is evaluated from the engineering and economic standpoint of safety techniques. In several limited regions of the German Democratic Republic, there are definite preexisting conditions for the application of these methods. However, in the majority of cases, these regions are not identical with the future sites of nuclear facilities. As far as a single and centralized disposal of solid and liquid wastes of all activity levels is concerned, the utilization of an old salt mine is evaluated as more advantageous in comparison to the other indicated methods. (auth)

6776 (ORNL-tr-2861) HEAT FACTOR IN THE PROBLEM OF THE UNDERGROUND DISPOSAL OF LIQUID RADIOACTIVE WASTES. Yudin, F. P. 1972. Translated from Russian. (CONF-7210129-3). 15p. Dep. NTIS $4.00.

From science-technical conference; Kolobzheg, Poland (2 Oct 1972).

In the disposal and decay cooling of liquid radioactive wastes in subsurface depositories, physicochemical processes occur depending on the nature of the radionuclides and other components present in the wastes. Heating of the medium containing the wastes is one of the important processes occurring in the depository. This paper deals with the energy characteristics of some radionuclides of fission origin and their mixtures, representing radioactive wastes having various specific activity levels. It has been shown that the heating temperature depends on the specific activity of the wastes, relative content of long-lived isotopes, and sorption capacity of the geological structure of the depository layer. Low-level wastes do not cause any significant heating of the medium. The intermediate-level wastes may, depending on the sorption capacity of the soil, increase the temperature of the medium by dozens of centigrades, and the high-level wastes, by hundreds of centigrades. Specific examples of the solution of the spatial problem are presented, and the temperature fields of the depository layer at various times are given; furthermore, the paper contains the solutions of the thermal conductivity problem for a rod, with a diagram of the temperature change along the z axis for various times. (auth)

6777 (ORNL-tr-2862) STUDIES AND TECHNOLOGY OF THE SUBSURFACE DISPOSAL OF LIQUID RADIOACTIVE WASTES. Pimenov, M. K. 1972. Translated from Russian. (CONF-7210129-2). 14p. Dep. NTIS $4.00.

From science-technical conference; Kolobzheg, Poland (2 Oct 1972).

The problem of the feasibility, safety, and technical and economic advisability of the underground burial of radioactive wastes has been solved as a result of a complex geological-hydrogeological study of the proposed region for the site of an underground depository, and also as a result of physico-chemical, scientific-technical, and safety studies. In the first part of this paper, the methods of the geological exploration are discussed including extent and types of basic research and studies, as well as their objectives. The main problems of the physicochemical, scientific-technical, and safety problems are described. The basic starting data necessary for the development of the underground depository are enumerated. The second part of the paper presents data on the technology of the underground burial of liquid radioactive wastes

in the Soviet Union for two enterprises as well as information on the disposal of highly toxic, industrial effluents of the chemical and petrochemical industries in the USSR and abroad. The design of the subsurface depositories and certain design features of the underground and surface facilities, as well as information on the organization and operating conditions of the facilities are given. The reliability and safety of this method of waste disposal under favorable geological and hydrogeological conditions are shown. In conclusion, the technical and economic parameters are presented for a number of subsurface depositories. (auth)

6778 COMMENTS ON THE DEPOSITION OF RADIOACTIVE SEWAGE SLUDGE IN LEOPOLDSHAFEN. Atomwirtsch., Atomtech. Anhang.; 19: No. 8/9, 2(Aug 1974). (In German).

The final report of the Ministry is briefly summarized, discussing the differing interpretations of paragraphs 7 and 42 of the first Radiation Protection Ordinance. The board of supervisors of the GfK confirms the controversy about this problem which has to be solved by the Federal Ministry for Internal Affairs and is, therefore, not planning to take any measures with regard to the members of the GfK responsible for the sewage deposition before this issue has been clarified. (GE)

6779 TRANSURANIUM NUCLIDES IN THE ENVIRONMENT FROM MANAGEMENT OF SOLID RADIOACTIVE WASTE. Daly, G. H.; Kluk, A. F. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 74-75(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6780 STORAGE FEE ANALYSIS FOR COMMERCIAL HIGH-LEVEL WASTES. Field, B. B. (Atlantic Richfield Hanford Co., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 203(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6781 NUCLEAR WASTE DISPOSAL UTILIZING A GASEOUS-CORE REACTOR. Paternoster, R. (University of Florida, Gainesville); Ohanian, M. J.; Schneider, R. T.; Thom, K. (National Aeronautics and Space Administration, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 203-204(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6782 SELECTION OF SIGNIFICANT ELEMENTS AND RADIONUCLIDES FOR WASTE MANAGEMENT ASSESSMENT. Logan, S. E.; Whan, G. A. (University of New Mexico, Albuquerque). Trans. Amer. Nucl. Soc.; 19: 204-206(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6783 HALF-WAY ANALYSES OF THE SIMULATED RELEASE OF HIGH-LEVEL NUCLEAR WASTE DURING UNDERGROUND GEOLOGIC STORAGE. Jansen, G.; Corley, J. P.; Routson, R. C.; Baker, D. A.; Burkholder, H. C. (Battelle-Northwest Labs., Washington, DC). Trans. Amer. Nucl. Soc.; 19: 208-209(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6784 MANAGEMENT OF COMMERCIAL RADIOACTIVE WASTE. Pittman, F. K. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 211-212(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6785 PROBABILISTIC-RISK MODELING OF NUCLEAR RADWASTE FACILITIES. Lehmann, P. H. (Westinghouse Electric Corp., West Mifflin, PA); El-Bassioni, A. A. Trans. Amer. Nucl. Soc.; 19: 236-237(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Handling Equipment and Procedures

Refer also to abstract 7442.

6786 (CEA-CONF-2697) VIRGULE: A RESCUE VEHICLE OF THE NEW TELEOPERATOR GENERATION. Vertut, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1974. 17p. (CONF-740351-1). Dep. NTIS (US Sales Only) $4.00.

From 2nd conference on industrial robot technology; Birmingham, UK (27 Mar 1974).

The machine described is remote controlled and carries one pair of telemanipulators and TV cameras. VIRGULE is equipped with one pair of MA 22 compact bilateral servo master-slave manipulators, capable of exerting a 120 Newtons (12 kg) force in any direction and of lifting up to 40 kg in certain positions. (auth)

6787 (CONF-740474-1) GLOVES USED IN GLOVEBOXES IN ELECTROMAGNETIC ISOTOPE SEPARATIONS AT OAK RIDGE NATIONAL LABORATORY. Scheitlin, F. M. (Oak Ridge National Lab., Tenn. (USA)). [nd]. 25p. Dep. NTIS $4.25.

From first Rocky Flats glovebox conference; Golden, Colorado, USA (30 Apr 1974).

The Wilson-130 glove used in the gloveboxes for processing radioisotopes in the Electromagnetic Isotope Separations Department at ORNL is described. The glove is synthetic latex and is attached to a polyvinylchloride sleeve. Cost of the glove is about $3.00 a pair. (TFD)

6788 USE OF BOROSILICATE-GLASS RASCHIG RINGS IN A HOSTILE ENVIRONMENT. Nurmi, E. O. (Babcock and Wilcox Co., Lynchburg, VA). Trans. Amer. Nucl. Soc.; 19: 181(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6789 ARRAY POISONING. Gutman, T. (Combustion Engineering Co., Windsor, CT). Trans. Amer. Nucl. Soc.; 19: 181-183(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6790 CRITICALITY OF HETEROGENEOUS SYSTEMS: UO_2-PuO_2 SOLIDS IN FISSILE SOLUTION CONTAINING GADOLINIUM NITRATE. Lloyd, R. C.; Clayton, E. D. (Battelle-Northwest Labs., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 183-184(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6791 SOLUBLE POISONS AND CHEMICAL PROCESSING EQUIPMENT AT ICPP. Eggert, J. A. (Allied Chemical Corp., Idaho Falls, ID). Trans. Amer. Nucl. Soc.; 19: 184-185(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6792 APPLICATION OF BOROSILICATE RASCHIG RINGS FOR PRIMARY CRITICALITY CONTROL. Schuske, C. L.; McCarthy, J. D. (Dow Chemical Co., Golden, CO). Trans. Amer. Nucl. Soc.; 19: 185-187(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6793 CRITICALITY OF PERIODICALLY BORON-POISONED ENRICHED-URANIUM-SOLUTION SYSTEMS. Rothe, R. E. (Dow Chemical Co., Golden, CO). Trans. Amer. Nucl. Soc.; 19: 187-188(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6794 EMPIRICAL MODEL TO ESTIMATE ENERGY RELEASE FROM ACCIDENTAL CRITICALITY. Olsen, A. R. (Battelle-Northwest Labs., Richland, WA); Hooper, R. L.; Uotinen, V. O.; Brown, C. L. Trans. Amer. Nucl. Soc.; 19: 189-191(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6795 ACCIDENTAL FISSILE SOLUTION EXCURSIONS AND BUILDING DESIGN CRITERIA. Tuck, G. (Dow Chemical Co., Golden, CO). Trans. Amer. Nucl. Soc.; 19: 191(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6796 ANALYTICAL STUDIES OF CRITICALITY ACCIDENTS IN AQUEOUS SOLUTIONS. Forehand, H. M. Jr. (Argonne National Lab., Idaho Falls, ID). Trans. Amer. Nucl. Soc.; 19: 191-193(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6797 AVAILABLE RESOURCES FOR THE DESIGN AND SAFETY ANALYSIS OF PROCESSING PLANTS. Seale, R. L.; Hetrick, D. L. (Univ. of Arizona, Tucson). Trans. Amer. Nucl. Soc.; 19: 193(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6798 RECOVERY AND RESTORATION PHASES OF A CRITICALITY ACCIDENT. Cronin, D. F. (United Nuclear Corp., Columbia, MO). Trans. Amer. Nucl. Soc.; 19: 193-194(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6799 OAK RIDGE Y-12 PLANT CRITICALITY-ACCIDENT EMERGENCY PROGRAM. Mee, W. T.; McLendon, J. D. (Union Carbide Nuclear Corp., Oak Ridge, TN). Trans. Amer. Nucl. Soc.; 19: 194-195(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6800 NUCLEAR-ACCIDENT DOSIMETRY IN A SIMULATED CRITICALITY ACCIDENT. Santoro, R. T.; Affel, R. G.; Cain, G. C.; Greene, J. H. (Union Carbide Corp., Oak Ridge, TN). Trans. Amer. Nucl. Soc.; 19: 195-196(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6801 CRITICALITY ANALYSIS OF THE ACPR FUEL STORAGE CONTAINER. Philbin, J. S.; Estes, B. F.; Morris, F. M. (Sandia Labs., Albuquerque, NM). Trans. Amer. Nucl. Soc.; 19: 198-199(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6802 EXPERIMENTAL MEASUREMENTS WITH ARRAYS OF U(97.7)F_6 NEUTRON-COUPLED THROUGH CONCRETE. Thomas, J. T. (Union Carbide Nuclear Corp., Oak Ridge, TN). Trans. Amer. Nucl. Soc.; 19: 199-200(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6803 CRITICALITY SAFETY ANALYSIS OF THE SPECIAL BNW NUCLEAR MATERIALS STORAGE FACILITY. Davenport, L. C. (Battelle-Northwest Labs., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 200-201(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6804 EVALUATION OF VERY LOW MODERATION LOW-ENRICHMENT UO_2 SYSTEMS. Welfare, F. G. (Babcock and Wilcox Co., Lynchburg, VA). Trans. Amer. Nucl. Soc.; 19: 201-202(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6805 GOOD NEIGHBOR POLICY FOR FUEL FABRICATION PLANTS. Haley, J. (Westinghouse Electric Corp., Pittsburgh). Trans. Amer. Nucl. Soc.; 19: 210(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6806 DRY-HANDLING SYSTEM FOR AN LWR SPENT-FUEL SHIPPING CASK. Ridgway, J. R. (Houston Lighting and Power Co., TX); Sobey, T. M.; Jones, C. R.; Weinstein, A. A. Trans. Amer. Nucl. Soc.; 19: 228(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6807 SYSTEMS ANALYSIS OF CRITICALITY SAFETY. Hall, R. J.; Clayton, E. D. (Battelle-Northwest Labs., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 233-234(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6808 OPERATIONAL EXPERIENCE OF THE ALPHA-GAMMA FACILITY AT PNC O-ARAI ENGINEERING CENTER. Uematsu, K.; Ishida, Y.; Kobayashi, S.; Komatsu, J. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). Trans. Amer. Nucl. Soc.; 19: 424-425(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6809 MATERIALS MONITORING FACILITY FOR FAST REACTOR MATERIALS TESTING. Uematsu, K.; Ishida, Y.; Suzuki, K.; Yamanouchi, S. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). Trans. Amer. Nucl. Soc.; 19: 425-426(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6810 FUEL MONITORING FACILITY FOR FAST REACTOR FUEL SUBASSEMBLY EXAMINATIONS. Uematsu, K.; Ishida, Y.; Seki, S.; Hayashi, T. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). Trans. Amer. Nucl. Soc.; 19: 426-427(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6811 REMOTE APPLICATION OF AN OSCILLATORY SYSTEM FOR DENSITY MEASUREMENTS. Fortsch, E. M.; Wade, M. A. (Allied Chemical Corp., Idaho Falls, ID). Trans. Amer. Nucl. Soc.; 19: 427(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6812 SODIUM AEROSOL TRAPS FOR MODERATE GAS FLOW RATES AT ELEVATED TEMPERATURES. Bain, S.; Mullen, R.; Harbison, S. G. (Aerojet Manufacturing Co., Fullerton, CA). Trans. Amer. Nucl. Soc.; 19: 427-428(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6813 HIGH EXPOSURE PLUTONIUM FUELS FROM LIGHT-WATER REACTORS. Faust, L. G.; Brackenbush, L. W. (Battelle-Northwest Labs., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 431(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6814 OCCUPATIONAL RADIATION EXPOSURE CONTROL IN MIXED-OXIDE FUEL FABRICATION PLANTS. Willis, C. A. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 431(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6815 SAFETY IN PuO_2 FUEL FABRICATION. Williams, R. A.; Crosby, E. H. (Nuclear Materials and Equipment Corp., Apollo, PA). Trans. Amer. Nucl. Soc.; 19: 432(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6816 DEVELOPMENT OF A ZOOM MACROSCOPE FOR RADIOACTIVE NUCLEAR MATERIALS. Banks, D. A.; Eggers, A. G. (United Kingdom Atomic Energy Authority, Sellafield, Eng.). J. Microscopy; 101: 283-289(Aug 1974).
The macroscopic examination of irradiated reactor materials presents special problems in handling due to the necessity of shielding the instrument from the worker with a thick lead wall. The lack of availability of a suitable instrument has prompted the design of a special inverted stage macroscope equipped for remote operation. As the size of lens prevents turret mounting, a commercial 35 mm camera telephoto lens has been adapted in a special focusing mount. This permits the illuminator and stage assembly to be made non-adjustable, simplifying the problems of remote working. An electronic drive is fitted to each stage movement, both of which are provided with remote position indicators. (auth)

Transportation

Refer also to abstract 7451.

6817 (BNWL-1847) FUTURE CONSIDERATIONS IN THE SHIPMENT OF PLUTONIUM. Brackenbush, L. W.; Brown, C. L.; Faust, L. G. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Oct 1974. Contract AT(45-1)-1830. 13p. Dep. NTIS $4.00.
By 1985, plutonium production from LWR's will increase from 2 metric tonnes (MT)/year to about 43 MT/year. The specific activity of this plutonium will be a factor of about four higher than todays production grade plutonium. At the same time heat generation per gram of plutonium will increase by a factor of about four. Based on the data presented, it is concluded that heat loads and radiation levels associated with high exposure plutonium will require many changes in future shipping practices for this type materials. Incorporation of neutron shielding in packaging is expected to be required as will redesign to accommodate increased heat loads. Moreover, safeguards considerations are expected to bring about the use of specially designed trucks for plutonium transport. These trucks will incorporate special features to further help prevent theft while in transit. From the viewpoint of criticality safety, limitations on future package and truck loadings should be no more restrictive than at present. In some instances, criticality safety limitations may be relaxed slightly by taking credit for the lower fissile content of high exposure plutonium. An estimate of how much plutonium could be shipped in a truck, under the above mentioned conditions, was found to be about 1.5 MT plutonium (as PuO_2) per truck. This quantity would represent about one months production from a large separations plant. In the more distant future, one possible direction which might tend to simplify some of the transport related problems is the nuclear park concept. Under this concept onsite facilities would preclude the transportation of plutonium

over long distances. Nuclear reactors, the separation plant, and the fuel fabrication facilities, with emphasis on the latter two, would be located on one site and plutonium would be transported from one facility to another without actually entering the public transportation system. (auth)

6818 (ORNL-TM-1312(Vol. 14)) OBSOLETE CASK PROGRAM: INITIAL TESTS. Shappert, L. B.; Evans, J. H. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 53p. Dep. NTIS $5.45.

The Obsolete Cask Program was initiated to study the behavior of casks under specified destructive test conditions and to establish the adequacy of the calculational techniques that are presently employed to predict cask damage. Two casks were subjected to impact tests, which involved 30-ft drops onto a solid, essentially unyielding surface. The first cask, weighing about 6200 lb, was dropped on end, while the second, weighing about 6000 lb, was dropped twice on edge. Deformation to the casks was predicted before the tests, and the values obtained were compared with the test results. Both predicted cask deformations and accelerations agreed reasonably well with the measured values. (auth)

6819 (RFP-2244) ATMX-600 RAILCAR SAFETY ANALYSIS REPORT FOR PACKAGING (SARP). Adcock, F. E. (Dow Chemical U.S.A., Golden, Colo. Rocky Flats Div.). 14 Oct 1974. Contract AT(29-1)-1106. 37p. Dep. NTIS $4.00.

The ATMX-600 Series Railcar is used by the Rocky Flats Division of Dow Chemical U.S.A. for shipping low-level radioactive waste under the provisions of DOT Special Permit 5948. Fissile Class I shipments are authorized with the car loaded to capacity with drums containing up to 200 g of ^{239}Pu. Inner packaging may be polyethylene-lined steel drums or fiber glass-coated plywood crates. These massive double-walled steel cars provide the equivalent protection of a Type B package. Rapid loading and unloading of the 9- by 9- by 50 ft cargo space is accomplished by prepackaging the waste in standard 20-ft steel cargo containers. The ATMX-600 railcar will hold two cargo containers, each carrying 70 55-gallon drums and up to 44,800 lb gross weight. (auth)

6820 (SRD-R-33) CALCULATION OF HEAT TRANSFER INTO FINNED SURFACES, AND THE SARFIN CODE. Brook, A. J.; Shaw, P. M. (UKAEA Safety and Reliability Directorate, Culcheth). 1974. 43p. Dep. NTIS (US Sales Only) $5.25.

Calculations have been made of heat transfer from a high temperature external environment into relatively cool finned surfaces. This paper presents some of the results of the calculations and describes the computational model on which the results are based. Previous predictions that the presence of suitability designed fins could significantly reduce thermal input from a radiation environment have been confirmed, and it is demonstrated that the inclusion of convection heat transfer need not necessarily change this conclusion if the fins are large. The transient response of fin arrays may lead to a further reduction in thermal fluxes, and consequently a reduction in thermal stresses within the finned body. (auth)

6821 (Y-DD-160) SAFETY ANALYSIS REPORT FOR PACKAGING (OAK RIDGE Y-12 PLANT MODEL DT-7 PACKAGE FOR ENRICHED URANIUM). Dyer, H. R. (Oak Ridge Y-12 Plant, Tenn. (USA)). Dec 1974. Contract W-7405-eng-26. 17p. Dep. NTIS $4.00.

An evaluation was made of the Y-12 Model DT-7 shipping container for unirradiated enriched uranium to demonstrate its compliance with federal regulations governing the interstate transportation of fissile material. Destructive testing and engineering evaluations were made to demonstrate the structural integrity and thermal resistance of the package in meeting the physical testing requirements described in the AEC regulations. The KENO computer code was used to analyze the criticality safety of the package containing up to 500 g of uranium of any ^{235}U isotopic enrichment and at any hydrogen-to-uranium atomic ratio. The Model DT-7 package meets applicable regulations for Fissile Class II shipments of up to 500 g of ^{235}U in the form of homogenous solids at any enrichment and with any degree of hydrogenous moderation. (auth)

6822 GENERAL PROVISIONS OF THE ATOMIC ENERGY LAW. 1. Present Regulations for the Various Transport Media. 6. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. A0. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

The present regulations for the transport of dangerous materials in the different transport media are specified. (GE)

6823 GENERAL PROVISIONS OF THE ATOMIC ENERGY LAW. 4-47. Joint Transport of Different Packages. 1. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. A0. Baden-Baden, F.R. Germany; Nomos (Oct 1971). (In German).

Pages 23 to 26 of these regulations have been amended. (GE)

6824 GENERAL PROVISIONS OF THE ATOMIC ENERGY LAW. 5. Shipping Documents. 6. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. A0. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

Pages 26 and 27 of the regulations for shipping documents have been amended. (GE)

6825 GENERAL PROVISIONS OF THE ATOMIC ENERGY LAW. 6. Design Specimens and Package Specimens, Transport Authorization. 6. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. A0. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

Pages 27 and 28 of these regulations have been amended. (GE)

6826 GENERAL PROVISIONS OF THE ATOMIC ENERGY LAW. 7-9 (A0 p. 31-36) 6. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. A0. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

Pages 31 to 36 of these regulations have been amended. (GE)

6827 GENERAL PROVISIONS OF THE ATOMIC ENERGY LAW. 22. Requirements of the Transport Regulations. 6. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. A0. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

Pages 11 and 12 of these regulations have been amended. (GE)

6828 INTERNATIONAL REGULATION FOR THE TRANSPORTATION OF DANGEROUS MATERIALS BY TRAIN (RID). Annex C to EVO-Regulations for Materials and Objects not Allowed to be Transported or only Under Certain Conditions. 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C16. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

Pages 5 to 10 of the RID have been amended. (GE)

6829 ADR, ANNEX A. Regulations for Dangerous Materials and Objects (23 p. 506). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C23. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

Pages 5 and 6 of the annex A to the ADR have been amended. (GE)

6830 ADR, ANNEX A, PART II, CLASS IVb. RADIOACTIVE MATERIALS. Materials Enumeration (C24 p. 7-10). 5. Part Issue. Brandl, J.; Blechschmidt, M. (eds.). pp vp of Regulations for the Transport of Radioactive Materials. C24. Baden-Baden, F. R. Germany; Nomos ([nd]). (In German).

Pages 7 to 10 have been amended. (GE)

6831 ADR, ANNEX A, PART II, CLASS IVb. RADIOACTIVE MATERIALS. Packages. (C24, p. 17-18b; 21-34b; 43-46b and 49-50b). 5. Part Issue. Brandl, J.; Blechschmidt, M. (eds.). pp vp of Regulations for the Transport of Radioactive Materials. C24. Baden-Baden, F. R. Germany; Nomos ([nd]). (In German).

Pages 17 to 18b; 21 to 34b; 43 to 46b and 49 to 50b have been added to the regulations for packaging of radioactive materials. (GE)

6832 ADR, ANNEX A, PART II, CLASS IVb. Radioactive Materials. Remarks on the Shipping Bills (C24 p. 53-54b). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C24. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

Pages 53 to 54 of these regulations have been amended. (GE)

6833 ADR, ANNEX A, PART III, APPENDIX A.6. Part C. Test Procedures. Packing. 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C24. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

Pages 85 and 86 of these regulation have been amended. (GE)

6834 ADR, ANNEX A, PART III, APPENDIX A.9. Requirements for the Danger Signs. 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C24. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).

Pages 97 and 98 of the ADR, annex A, Part III, appendix A.9 have been amended. (GE)

6835 ANNEX B TO THE ADR: REGULATIONS FOR THE TRANSPORTATION MEDIA AND THE CARRIAGE. Chapter II. Special Regulations for the Transport of Dangerous Good of the Classes I to VII: General Data (C26 p. 29-30b). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C25. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Pages 29 to 30b have been amended. (GE)

6836 ANNEX B TO THE ADR: REGULATIONS FOR THE TRANSPORTATION MEDIA AND THE CARRIAGE. Appendixes. Appendix B. 1: Regulations for One-Unit Container-Trucks, and Container Sets and Removable Tanks to be Transported by Trucks (C25 p. 41-46). 5. and 4. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C25. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Pages 41 to 46 of the appendix B.1 to the annex B of the ADR have been changed. (AP)

6837 ANNEX B TO THE ADR: REGULATIONS FOR THE TRANSPORTATION MEDIA AND THE CARRIAGE. Appendixes. Appendix B. 1b: Regulations for Tank Containers (Constructive Form and Tests) (C25 p. 47-480). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C25. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Pages 47 to 480 of the appendix B. 1b to the annex B of the ADR have been changed. (GE)

6838 ANNEX B TO THE ADR: REGULATIONS FOR THE TRANSPORTATION MEDIA AND THE CARRIAGE. Chapter II. Special Regulations for the Transport of Dangerous Goods of the Classes I to VII: Special Regulations for the Charge, Discharge and Handling. Special Regulations for the Traffic of Vehicles. Provisional Regulations, Exceptions and Special Regulations for Certain Countries (C25 p. 37-40). 5. Part Issue. Brandl, J.; Blechschmidt, M. (eds.). pp vp of Regulations for the Transport of Radioactive Materials. C25. Baden-Baden, F. R. Germany; Nomos ([nd]). (In German).
Pages 37 to 40 of these regulations have been amended. (GE)

6839 ANNEX B TO THE ADR: REGULATIONS FOR THE TRANSPORTATION MEDIA AND THE CARRIAGE. Chapter II. Special Regulations for the Transport of Dangerous Goods of the Classes I to VII: General Plant Regulations (C25 p. 33-34b). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C25. Baden-Baden, F.R. Germany; ([nd]). (In German).
Pages 33 to 34b of these regulations have been amended. (GE)

6840 ANNEX B TO THE ADR: REGULATIONS FOR THE TRANSPORTATION MEDIA AND THE CARRIAGE. Chapter I. General Regulations for the Transport of all Sorts of Dangerous Goods. 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C25. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Chapter I of the annex B to the ADR has been completely changed. (GE)

6841 EUROPEAN AGREEMENT ON THE INTERNATIONAL TRANSPORT OF DANGEROUS MATERIALS BY ROAD (ADR) (C22 p. 1-2). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C22. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Pages 1 and 2 of part C22 have been amended. (GE)

6842 ROAD TRAFFIC. Preliminary Remarks. 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C2. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Some preliminary remarks have been added to the traffic regulations. (GE)

6843 REGULATION CONCERNING TRANSPORTABLE CONTAINERS AND FILLING DEVICES FOR PRESSURE GAS (C171 p. 17-18). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C171. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Pages 17 and 18 of the pressure gas decree have been amended. (GE)

6844 APPENDIX IX, ANNEX C TO THE EVO (RAILWAY TRAFFIC ORDINANCE) AND RID (INTERNATIONAL REGULATION FOR THE TRANSPORTATION OF DANGEROUS MATERIALS BY TRAIN). 1. Regulations for the Danger Signs, According to RID. 5. pp vp of Regulations for the Transport of Radioactive Materials. C17. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Pages 1 to 8 of the appendix of the RID have been amended. (GE)

6845 CLASS IVb. Radioactive Materials. Annex C to EVO (Railway Traffic Ordinance). Annex I of the RID (International Regulation for the Transportation of Dangerous Materials by Train). 465-469. 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C17. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Pages 63 to 66 of these regulations have been amended. (GE)

6846 IMCO CODE CLASS 7. Radioactive Substances. 6. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C43.1. Baden-Baden, F.R. Germany; Nomos ([nd]).
The IMCO Code Class 7 has also been included in the regulations for the transport of radioactive materials. (GE)

6847 AGREEMENT OF MARCH 6th, 1948 CONCERNING THE INTERGOVERNMENTAL MARITIME CONSULATIVE ORGANIZATION (IMCO). Excerpt. 6. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C43. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
An excerpt from the IMCO agreement has been included. (AP)

6848 MARITIME LAW. Excerpt. 6. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C41. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
An excerpt from the Maritime Law has been included in the regulations for the transport of radioactive materials. (GE)

6849 INTERNATIONAL AIR TRANSPORT ASSOCIATION RESTRICTED ARTICLES REGULATIONS (IATA-RAR). 6. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C34. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
An excerpt from IATA-RAR has been included in the regulations for the transport of radioactive materials. (GE)

6850 DECREE ON THE TRANSPORT OF DANGEROUS GOODS BY ROAD, ANNEX A. Regulations for Dangerous Materials and Objects (C29 p. 1-12). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C29. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Annex A has been added to the GefahrgutVStr. (GE)

6851 DECREE ON THE TRANSPORT OF DANGEROUS GOODS BY ROAD, ANNEX B. Regulations for the Transport and the Transport Media (C29 p. 1-8). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C29. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
Annex B has been added to the GefahrgutVStr. (GE)

6852 DECREE ON THE TRANSPORT OF DANGEROUS GOODS BY ROAD (GEFAHRGUTVSTR), MAY 10th, 1973 (BGBl. I. S. 449) (EXCERPT). 5. Part Issue. Brandl, J.; Blechschmidt, M. (Eds.). pp vp of Regulations for the Transport of Radioactive Materials. C29. Baden-Baden, F.R. Germany; Nomos ([nd]). (In German).
An excerpt from the Decree on the transport of dangerous goods by road has been included. (GE)

6853 DECREE ON DANGEROUS SEA FREIGHT GOODS, OF JANUARY 4th, 1960. 6. Part Issue. Brandl, J.; Blechschmidt, M. (eds.). pp vp of Regulations for the Transport of Radioactive Materials. C44. Baden-Baden, F. R. Germany; Nomos ([nd]). (In German).
Changes have been introduced to the decree on dangerous sea freight goods. (GE)

6854 DECREE ON DANGEROUS SEA FREIGHT GOODS OF JANUARY 4th, 1960. ANNEX 1, CLASS IVb. 6. Part Issue. Brandl, J.; Blechschmidt, M. (eds.). pp vp of Regulations for the Transport of Radioactive Materials. C45. Baden-Baden, F. R. Germany; Nomos ([nd]). (In German).
The decree on dangerous sea freight goods, annex 1, has been amended. (GE)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstracts 7155, 7358, 7374, 7666, and 7977.

6855 (AD-779264) NRL VAN DE GRAAFF OPERATION, 1 JANUARY–31 DECEMBER 1973. Dunning, K. L. (Naval Research Lab., Washington, D. C. (USA)). Apr 1974. 67p. (NRL-MR-2787). NTIS $3.75.

The report is the ninth in a series of summaries on the use and development of the NRL 5-MV Van de Graaff accelerator and associated instruments. In this reporting period (1 January to 31 December 1973), for the first time anywhere, a measurement to determine dose-rate effects in the simulation of neutron damage to reactor materials with 2.8-MeV nickel ions has been made. The nickel-ion flux was changed by a factor of 100, all other parameters being constant; the relationship between specimen swelling and temperature was determined for two fluxes. New species of ion beams are now available from the 100-keV ion-implantation accelerator; this apparatus has been used for many optical and electron device-related implantations. The very successful operation of the modified Hill-Nelson sputtering ion source in the Van de Graaff has opened the way to a wide variety of metallic ions with MeV energies. A new digital-optical telemetering system has added significantly to the efficiency of Van de Graaff operation. (GRA)

6856 (AD-779788) CERTAIN MECHANISMS OF ION ACCELERATION USING ELECTRON BEAMS. Kolomenskii, A. A.; Logachev, I. I. 19 Apr 1974. Translated from pp 119-121 from Symposium on Collective Methods of Acceleration, Dubna, USSR, 27–30 September 1972. (CONF-720952-9). 7p. NTIS $3.00.

From symposium on collective methods of acceleration; Dubna, USSR (27 Sep 1972).

Among the collective methods, ion acceleration using relativistic electron rings is currently attracting widespread attention. There are, however, possibilities for collective acceleration which do not require the use of rings, e.g., the long since proposed circuit of shifting foci. Certain other acceleration mechanisms which are possible in principle are examined. (GRA)

6857 (AD-780395) COLLECTIVE CYCLIC ACCELERATOR: A GYROTRON. Kolomenskii, A. A. 24 May 1974. Translated by C. T. Ostertag, Jr. from pp 115-118 of the Symposium on Collective Methods of Acceleration, Dubna, USSR, 27 September 1972. (CONF-720952-10; FTD-HT-23-1327-74). 9p. NTIS $3.00.

From symposium on collective methods of acceleration; Dubna, USSR (27 Sep 1972).

6858 (COO-3243-3, pp 141-150) OPERATION AND DEVELOPMENT OF THE RARAF FACILITY. Goodman, L. J.; Rohrig, N.; Marino, S. A.; Mills, R. E. 1 Jul 1974.

In annual report on research project.

The time schedule for the Radiological Research Accelerator facility is given. Improvements and developments in the Van de Graaff facility are outlined and future plans are reviewed. (WHK)

6859 (KFTI-73-24, pp 3-6) ELECTRON LINEAR ACCELERATOR OPERATION WITH PEAK ENERGY OF 2 GeV. Vishnyakov, V. A.; Grishaev, I. A.; Dobrolyubov, Yu. I.; Dem'yanenko, G. K.; Kobezskij, V. M.; Kondratenko, V. V.; Martynov, A. I.; Myakota, V. I.; Rubtsova, N. F. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

A diagram is given of the operation of the Kharkov linear accelerator (in 1972) with a maximum energy of 2 GeV. Causes of breakdown in individual systems are analyzed, and a classification of breakdowns is given. (INIS)

6860 (KFTI-73-24, pp 7-10) ON LUE-300 ACCELERATOR OPERATION IN 1972. Ivanov, G. M.; Kutya, G. A.; Makhnenko, L. A.; Ponomarenko, B. A.; Ryabka, P. M.; Salij, L. D. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Operation, in 1972, of a 300-MeV linear electron accelerator (LUE-300) is described. The annual program of operation and basic indexes of accelerator operation are compared with similar data for the year before. Overall reliability and efficiency of the accelerator are described. (INIS)

6861 (KFTI-73-24, pp 17-20) ON THE PARAMETER OPTIMIZATION OF SUPERCONDUCTIVE ELECTRON LINEAR ACCELERATORS WITH BEAM CIRCULATION. Levin, V. M.; Orlov, A. K.; Rumyantsev, V. V.; Ryabtsov, A. V.; Smirnov, V. L.; Sokolov, B. A. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

A superconducting linear accelerator, due to continuous (or semi-continuous) operation, low-energy scatter, and small current of accelerator particles, has practically unlimited possibilities for making any number of beam circulations, which results in an increase in its energy. This is the basis for proposing optimum properties of linear electron accelerators with a circulating beam for obtaining selected final values of energy and current as a function of the accelerator field and cost of construction, at least in the energy range where loss in the synchrotron radiation is markedly less than the increase in energy in one accelerator cycle. Optimization tests are described. (INIS)

6862 (KFTI-73-24, pp 32-33) EXPERIMENTAL FACILITY FOR THE PARTICLE ACCELERATION BY INTERRUPTION OF INTENSIVE ELECTRON BEAM. Grishaev, I. A.; Dement'ev, V. K.; Zakutin, V. V.; Zelencher, A. S.; Kozin, V. P.; Shenderovich, A. M. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Equipment is described for experimental study of the method of accelerating charged particles by chopping of an intense electron beam. The method involves electron beams with a long leading front and a short rear face to activate the resonator. The retarding voltage, due to passage of the long leading front, is small and in the case of the short rear face there is shock activation of the resonator with a high accelerating voltage. (INIS)

6863 (KFTI-73-24, pp 34) EXPERIMENT ON BEAM ACCELERATION WITH RESONATOR SHOCK EXCITATION. Grishaev, I. A.; Dedik, A. N.; Zakutin, V. V.; Magda, I. I.; Tkach, Yu. V.; Shenderovich, A. M. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Experimental results are presented on acceleration of an intense electron beam by shock activation of the resonator. The accelerator injector is a high-energy electron accelerator. The beam energy changes from 500 to 800 keV and the beam current in the resonator from 5 to 15 kamp. (tr-auth)

6864 (KFTI-73-24, pp 46-48) SPECIFIC FEATURES OF USING ACCELERATING WAVEGUIDE IN THE SPLIT MICROTRON. Volodin, V. A. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Recently there has been interest in the so called "split" microtron, in which the accelerating element is a linear electron accelerator. The split microtron is nothing other than a linear electron accelerator with a multiple circulating beam. One problem in linear accelerator theory is the load on the accelerating waveguide by the particle beam. In the split microtron it is aggravated by a number of similar factors. The results of a systematic study of this problem are reported. (INIS)

6865 (KFTI-73-24, pp 49-52) DESIGN OF THE SUPERCONDUCTIVE WAVEGUIDE ELECTRON ACCELERATOR. Volchkov, O. V.; Gurin, S. N.; Kosyakin, M. N.; Levin, V. M.; Orlov, A. K.; Rumyantsev, V. V.; Ryabtsov, A. V.; Smirnov, V. L.; Sokolov, B. A.; Khokhlov, V. K. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Construction of a superconducting accelerator requires solution of a number of complex engineering problems which may be considered on the basis of making a small accelerator. The project

described was designed to develop an operating superconducting waveguide electron accelerator. (INIS)

6866 (LBL-3049) BEVALAC: STATUS OF THE MACHINE AND OF THE PHYSICS RESEARCH PROGRAM. Hyde, E. K. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1974. Contract W-7405-eng-48. 26p. (CONF-740646-4). Dep. NTIS $4.50.

From Nobel symposium on superheavy elements; Ronneby, Sweden (10 Jun 1974).

The Bevalac is briefly described and its schedule for completion is given. The Physics Research Program to be carried out with heavy ion beams with energy in the range 0.250 to 2.1 GeV/nucleon is described. The Bevalac project consists of Superhilac heavy ion injection into the Bevatron. (auth)

6867 ACCELERATING STRUCTURE OF LINEAR ACCELERATORS ON THE BASIS OF TWO-WIRE LINES. Bessonov, E. G.; Kurakin, V. G.; Serov, A. V. Kratk. Soobshch. Fiz.; No. 3, 31-36(1974). (In Russian).

The possibility of constructing accelerating structures on the basis of two-wire lines excited by a high-voltage pulsed generator is discussed. An expression is obtained for the intensity of the accelerating electric field. The dynamics of the particles in the structure are examined. The dispersion properties of models of the structure were studied experimentally. (tr-auth)

6868 IRONLESS LINEAR INDUCTION ACCELERATORS. Pavlovskii, A. I.; Boamykin, V. S. At. Energ. (USSR); 37: No. 3, 228-233(Sep 1974). (In Russian).

Electrodynamic and structural features of ironless linear induction accelerators (LIA) based on torodal oscillating circuits are discussed. The most important schemes of ironless LIA's have been classified and transient processes in inductors with lumped capacitance, as well as in torodial-line inductors with distributed parameters, have been analyzed. Required parameters of inductors for increased efficiency, power and accelerating electric field intensity have been determined. (auth)

6869 HIGH-CURRENT COLLECTIVE ACCELERATORS. Chuvilo, I. V.; Kapchinskii, I. M.; Koshkarev, D. G.; Zenkevich, P. R.; Plotnikov, V. K.; Gloenko, Yu. G. At. Energ. (USSR); 37: No. 3, 223-227(Sep 1974). (In Russian).

The major effects arising during electron-ion ring acceleration in a static magnetic field are considered. Taking into account these effects, the authors have calculated possible parameters of a high-current magnetostatic accelerator of the meson factory type (1 mA current and 1 GeV energy per nucleon) for a high coefficient of electron-ion energy transfer. It has been shown that the parameters can be optimized by varying the charge-to-mass ratio of the accelerated current. (15 references) (auth)

6870 STANDING WAVE TYPE LINEAR ACCELERATOR. Takada, K. (To Tokyo Shibaura Electric Co. Ltd.). Japanese Patent 1973, 15558. 5 Dec 1968. 3p. (In Japanese).

This invention relates to a standing wave linear accelerator which can effectively accelerate a large amount of electric current by decreasing the Q value of the TM_{11} mode. The accelerator consists of an electron gun and a target at both ends of an accelerating tube which is provided with combination cavities at constant intervals. The surface current of the TM_{11} wave which is parallel to the Z-axis is cut or decreased by providing an aperture in each of the combination cavities. The accelerating mode is not affected by the aperture because of the symmetry of the mode, hence the Q-value of the TM_{11} mode can be greatly decreased without affecting the Q-value of the accelerating mode. The accelerating tube vacuum can be kept by filling the aperture with insulating materials having large dielectric loss. An insulating material with large dielectric loss may be applied on the inner surface of the cavities instead of providing an aperture to each cavity. (JA)

6871 TONUS HIGH-CURRENT ELECTRON ACCELERATOR. Gleizer, I. Z.; Dronova, L. P.; Zherlitsyn, A. G.; Kotlyarevskii, G. I.; Okulov, B. V.; Tak, V. S.; Remnev, G. E.; Rudenko, N. S.; Tuzov, V. A.; Smetanin, V. I.; Usov, Yu. P.; Shatanov, A. A. (Tomsk Polytechnic Inst., USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 642-645(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 17-20(1974).

A high-current electron accelerator rated at an energy of up to 2 MeV with a beam current of up to 80 kA for a beam duration of ~40 nsec is described. The pulse of accelerated voltage is created by means of a double shaping line with pulse charging from an Arkad'ev–Marx generator. Commutation of the current in the shaping line is accomplished by a multichannel gas spark gap. The electrons are emitted by cold cathode and accelerated in a one-gap accelerating space. Prime attention in the paper is devoted to the electrical portion of the accelerator. (auth)

6872 INSTALLATION FOR TESTING ELECTRON GUNS WITH RECUPERATION OF THE PARTICLE ENERGY. Zav'yalov, M. A., Perevodchikov, V. I.; Timofeeva, G. G.; Yumatov, K. A. (All-Union Electrical Engineering Inst., Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 646-648(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 20-22(1974).

An installation is described for testing electron guns with recuperation of the energy of intense electron beams. Results are presented of an experimental investigation of the deceleration of electron beams which are shaped by electron guns having both plasma and thermionic cathodes in a collector system of the Faraday-cylinder type. (auth)

6873 LINEAR PARTICLE ACCELERATOR SYSTEM HAVING IMPROVED BEAM ALIGNMENT AND METHOD OF OPERATION. McIntyre, R. D.; Nunan, C. S. (to Varian Associates). US Patent 3,838,284. 24 Sep 1974. Filed Date 26 Feb 1973. 10p.

A linear particle accelerator having detection apparatus for detecting the presence of and correcting for beam misalignment is described. The linear accelerator includes a charged particle accelerator system and deflection coils for changing both the positional and angular displacement of a charged particle beam. A target is disposed in the particle beam path for emitting X-rays upon being struck by the charged particles. The photon field pattern developed by the target takes the form of a forward-peaked lobe configuration extending from the target. An arrangement of radiation responsive electrodes is disposed in the radiation field for developing electrical signals responsive to changes in the lobe pattern. The signals developed by the radiation responsive electrodes are applied to differential servo circuitry for applying signals to the deflection coils to correct for both positional and axial misalignment of the particle beam. (25 Claims, 5 Drawing Figures) (Official Gazette)

Auxiliaries and Components

6874 (AD-779613) RADIATION SAFETY IN THE DESIGN AND OPERATION OF HIGH-POWER BETATRONS. Mamin, E. B.; Terman, A. V.; Chistov, E. D. Translated by E. Weppner from Gig. Sanit.; No. 4, vp (Apr 1971). 8p. (FSTC-HT-23-1790-72). NTIS $4.00.

A simplified method is suggested for computing biological shielding for high-power betatrons which is accurate enough for solving practical problems of attenuation of bremsstrahlung, foreign, and accompanying electromagnetic radiations. In practice it can be considered that the effective energy of quanta of bremsstrahlung radiation is equal to one half the maximum energy of bremsstrahlung beta-particles at $E_{max} \leq 10$ MeV and to one third the maximum energy if 10 MeV $\leq E_{max}$ 30 MeV. (GRA)

6875 (ANU-P-603) MULTIPLE HALL PROBE UNIT FOR MAGNETIC FIELD MEASUREMENTS. Stewart, J. D.; Ophel, T. R. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Sep 1974. 5p. Dep. NTIS (US Sales Only) $4.00.

Inexpensive yet reliable Hall probe units have been in use with the A. N. U. EN tandem and 14 UD accelerators for some time. The unit associated with the EN tandem operates simultaneously four Hall probes which are located in the ion source 20° deflection magnet, the two three-port switching magnets, and in the field of a 61 cm double-focusing spectrometer. The spectrometer probe extends field measurement beyond the range possible with a conventional NMR probe surrounded by trim coils to buck the non-uniform field components. A second unit operates probes in the ion source inflection magnet, the 90° analyzing magnet and seven-port switching magnet of the 14 UD accelerator. (WHK)

6876 (BNL-18832) USE OF A GENERAL-PURPOSE TIME-SHARED COMPUTER IN ACCELERATOR CONTROL. Barton, M. Q.; Culwick, B. B.; Curtiss, J. A.; Dabrowski, J. J.; Frankel, R. S.; Harrison, W. E.; Martin, F. R.; Smith, J. D.; Warkentien, R. J.; Weitman, I. (Brookhaven National Lab., Upton, N. Y. (USA)). [nd]. 8p. (CONF-740563-1). Dep. NTIS $4.00.

From 9th international conference on high energy accelerators; San Francisco, California, USA (2 May 1974).

A general purpose real-time data acquisition and control system implemented on a PDP-10 time shared computer and interfaced to devices via PDP-8 peripheral processors and a serial transmission scheme has been constructed for the Brookhaven AGS. The design objectives of Fortran coded time-shared access to the accelerator have been achieved under the manufacturer's monitor with the addition only of shareable device handlers. The time-sharing monitor has allowed the development and operation of alternative control systems in parallel with continued use of an earlier system. Program development has been facilitated by the

convenient access provided by the operating system and the multiple terminals available for programming and testing. (auth)

6877 (BNL-19289) CHRONICLE OF SUPERCONDUCTING DEVICES AT BNL. Dahl, P. F. (Brookhaven National Lab., Upton, N. Y. (USA)). 14 Aug 1974. 48p. Dep. NTIS $5.50.

The various ongoing programs in applied superconductivity supported by BNL are summarized, including the development of high field ac and dc superconducting magnets for accelerators and other applications, microwave deflecting cavities for high energy particle beam separators, cables for underground power transmission, and a materials research effort pursuing methods of fabricating new superconductors and metallurgical properties affecting the performance of superconducting devices. (55 references) (auth)

6878 (CERN-74-21) RADIATION MEASUREMENTS AROUND THE FERMILAB 300 GeV MAIN ACCELERATOR. Awschalom, M.; Yovanovitch, D. D.; Goebel, K.; Lambert, K. P.; Ranft, J.; Wilson, E. (Fermi National Accelerator Lab., Batavia, Ill. (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 9 Sep 1974. 36p. (NAL-TM-516). Dep. NTIS (US Sales Only) $5.00.

Dose and flux density measurements were made around the Fermilab main accelerator and compared to Monte Carlo calculations for estimating doses at the CERN II Synchrotron. The measurements give credibility to the Monte Carlo calculations. (WHK)

6879 (CONF-740957-5) HIGH-PERFORMANCE Nb HELICAL CAVITY. Benaroya, R.; Clifft, B. E.; Johnson, K. W.; Markovich, P.; Wesolowski, W. A. (Argonne National Lab., Ill. (USA)). 30 Sep 1974. 5p. Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

A 92-MHz superconducting-Nb helix resonator of exceptional quality has been thoroughly tested under a variety of conditions. The unit is a full-scale $\lambda/2$ structure with dimensions appropriate for heavy-ion acceleration. When operated at a temperature of 1.8 K and with bare (not anodized) Nb surfaces, the low-field Q is 9.4×10^9, equivalent to a surface resistance of 5×10^{-10} ohms. The maximum surface magnetic field is 1200 G and the maximum surface electric field is 37 MV/m, which corresponds to a traveling-wave axial accelerating field of 4.6 MV/m. These characteristics set new performance standards for helix resonators. A systematic study of the effects of various surface treatments, including abuses of the cavity, are described. The tests consist of 24 liquid helium cool-downs, at 4.2 K and 1.8 K, of the cavity with bare and anodized Nb surfaces which at various times were electropolished, oxypolished and heat treated. RF and helium conditioning are discussed as techniques to get through multipactoring barriers and extend the maximum obtainable electric field. (auth)

6880 (CONF-740957-12) ENGINEERING DESIGN AND ANALYSIS OF LARGE SUPERCONDUCTING PARTICLE ANALYSIS MAGNETS. Heim, J.; Fast, R. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). 30 Sep 1974. 8p. Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

Superconducting magnet technology is one phase of applied superconductivity where significant electrical power savings may be appreciated. Furthermore, these power savings may be gained without sacrificing reliability of operation or initial capital costs. The design and construction of 4 large superconducting dipole magnets which are being used at Fermi National Accelerator Laboratory to conduct high energy physics experiments are described. Two of these magnets have been built and operated continuously for several months prior to installation in beam lines. Two larger superconducting dipoles are presently under construction and both magnets will be completed this year. All magnets are designed to operate continuously without special attention consuming approximately 10% of the power which would be demanded by a conventional magnet. The engineering concept and construction techniques are described. (auth)

6881 (CONF-740957-19) RESULTS OF MAGNET PROTOTYPE EVALUATION FOR THE FERMILAB ENERGY DOUBLER PROJECT. Strauss, B. P.; Sutter, D. F.; Ioriatti, E.; Habrylewicz, W. (Fermi National Accelerator Lab., Batavia, Ill. (USA)). 1974. 4p. Dep. NTIS $4.00.

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974).

The Fermilab Energy Doubler project will require some 744 dipoles 6 meters long and 240 quadrupoles of varying lengths from 1.5 meters to 2 meters. Since earliest conception the Energy Doubler has been envisaged as an adjunct accelerator located in the same tunnel as the present Main Ring and capable of reaching a final proton energy of ~1000 GeV. To do this using a lattice similar to the Main Ring's requires a bending field of 45 kilogauss and, consequently, superconducting magnets. The magnet fabrication and testing program was initiated in September 1972, operated the first test magnets in January 1973, settled on a shell type geometry by June 1973, tested and evaluated a matched set of dipoles by November 1973 and operated the first 6 meter, or "20 ft", prototype dipole by March 1974. The 20 ft dipole did not perform satisfactorily, reaching less than 50% of design current and exhibiting excessive training. Consequently, a redirection of the program channeled further efforts into a 2.5 ft model program to identify and correct the sources of difficulty and to enable resumption of 20 ft prototype construction. The first phase of the 2.5 ft program has included the construction and testing of 12 magnets and is essentially complete. It has led to the promise of an improved wire and a slightly more conservative magnet design that is now being used in the construction of 2 ½ and 10 ft models. Events in an intensive development program do not proceed in logical sequence. While the 2.5 ft model program has been in active progress, two additional 20 ft prototype dipoles of the original design and one 7 ft quadrupole have been completed. One of these, 20 ft dipole #2, has been successfully operated in the forced flow liquid helium pump loop. A 7 ft warm iron quadrupole has also been tested successfully and would be adequate in present form for use in the Doubler project. (auth)

6882 (JINR-P9-8118) MEASUREMENT OF THE INSTANTANEOUS VALUE OF MAGNETIC FIELDS. Lachinov, V. M.; Makoveev, V. K. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1974. 25p. (In Russian). Dep. NTIS (U. S. Sales Only) $4.50.

A two-channel Hall magnetometer for measurement of the multiple (at limits of 1 μsec) values of magnetic fields and their gradients was developed. The range of measurable fields is from 0.01 to 2.5 T with a measurement precision of 0.1%. The pulsed power supply of the Hall transducer with stable current up to 1 amp was measured. The induced induction at the inlet circuit was significantly reduced. The calibration of the device was made in a constant magnetic field with a NMR magnetometer. (tr-auth)

6883 (KFTI-73-24, pp 22) ON EFFECT OF GAS STATE CHANGE IN COOLED RESONATOR CAVITY ON ITS PROPERTIES. Zykov, A. I.; Knyazev, B. R.; Plisko, V. N.; Kushnir, V. A. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Data are presented on the change in frequency upon cooling to 77 and 4.2°K of resonators with change in pressure of gaseous Ne (technical grade) and He (from the liquefier gas holder) in the resonator cavity. (tr-auth)

6884 (KFTI-73-24, pp 42-45) SOME QUESTIONS OF THE INCREASING LIFETIME OF THE PULSE POWER KLYSTRONS KIU-12. Martynov, A. I.; Tur, Yu. D. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Fifty simultaneously operating high-power pulsed klystrons (KIU-12) were used on the 2-GeV linear accelerator. Recently a number of improvements have been made on the accelerator which allow considerable shortening of maintenance shutdowns and lengthening of the continuous operating cycle to 1500 hr. In the present work, based on statistical data from the development of klystrons on the accelerator, the dependence of longevity of the equipment on the warm-up rate of the cathode was determined. (INIS)

6885 (KFTI-73-24, pp 53-54) COUPLING ELEMENT FOR A WAVEGUIDE LINE. Mufel', V. B.; Nikitina, T. F. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The construction is described of the coupling elements of a type widely used in a high-frequency feed for the 2-GeV linear electron accelerator as the simplest distributor of power from waveguide tracks for control of bending and frequency-phase properties of super-high-frequency pulse signals. (INIS)

6886 (KFTI-73-24, pp 55-56) FAST PROTECTION OF THE WAVEGUIDES. Vasil'ev, E. P.; Mufel', V. B.; Nikitina, T. F. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Depending on the engineering conditions in the use of power super-high-frequency generators, they must be provided with protective structures which decrease the power level or shut down the generator upon a rupture in the exit waveguide track. Protective structures are described which use the spark discharge in the waveguide resonator. (INIS)

6887 (KFTI-73-24, pp 57-58) AUTOOSCILLATOR WITH THE AMPLIFIED KLYSTRON WITH THE SUPERCONDUCTIVE RESONATOR. Kushnir, V. A.; Zlunitsyn, Eh. S.; Zykov, A. I. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The parameters of an autogenerator on an accelerator klystron of moderate power, containing in the chain a reverse connection of the high-conducting resonator, is described. The design may be used as a generator for high-frequency feed to equipment designed for high requirements and frequency stability. (INIS)

6888 (KFTI-73-24, pp 59-60) ON THE QUALITY MEASUREMENT OF THE SUPERCONDUCTIVE CAVITY RESONATORS. Zykov, A. I.; Zlunitsyn, Eh. S.; Kushnir, V. A.; Knyazev, B. R.; Mazmanishvili, A. S. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

A method is described for measuring the quality of superconducting resonators in the super-high-frequency range. The method is very simple and very precise. (INIS)

6889 (KFTI-73-24, pp 61-62) AUTOMATIC CONTROL OF THE ACCELERATING SECTION TEMPERATURE OF THE 2 GeV LINEAR ACCELERATOR. Demidov, N. V.; Strona, V. M. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

A block diagram is given of an automatic temperature control for the 2-GeV linear electron accelerator. The temperature conditions may be maintained only with definite control during operation of the thermostatting of each cell and the system as a whole. Under conditions of a multi-section accelerator, control of the system is most conveniently centralized by automatic measurement of the temperature of each accelerating section according to a definite time cycle. The main scheme of the commutator and control block is shown. (INIS)

6890 (KFTI-73-24, pp 63-64) USING VACUUM PUMP (TEhN-30) AS A LEAK DETECTOR OF THE 2 GeV LINEAR ACCELERATOR. Bazaev, Yu. M.; Glazkov, V. A. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Results are given of the use of a magnetically charged pump as a current probe on a 2-GeV linear electron accelerator. A vacuum of at least 5×10^{-7} torr is ensured with this device. (INIS)

6891 (KFTI-73-24, pp 65-66) DECODING OF FALSE AND TRUE SWITCHINGS OF ACCIDENTAL VACUUM VALVES AT THE 2 GeV LINAC BY MEANS OF LOGICAL ELEMENTS. Bazaev, Yu. M.; Glazkov, V. A. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

For emergency protection of a 2-GeV linear electron accelerator in vacuum stream phenomena, a fast-acting automatic channel is used with a time response of 20 sec. A diagram for control by valves is given. Use of this arrangement shortens by 60% the downtime of the accelerator due to malfunction of the vacuum system because of a false response of emergency valves. (INIS)

6892 (KFTI-73-24, pp 67-70) USE OF POWER KLYSTRON IN AUTOGENERATION REGIME AS AN EXCITER OF ELECTRON LINEAR ACCELERATORS. Oksuzyan, G. G.; Laziev, Eh. M.; Serov, V. L.; Beloglazov, V. I.; Grishaev, I. A.; Nikitina, T. F.; Sdobnova, L. N. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Results are presented of studies on the properties of a power klystron operating in a self-generation regime. The purpose of the studies was to determine the range of use of the system for supplying high-frequency power to a linear electron accelerator. (INIS)

6893 (KFTI-73-24, pp 71-72) "LONG-PULSE" OSCILLATOR-EXCITER. Beloglazov, V. I.; Chujkov, N. I. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

A long-pulse generator–activator is described with a duration of no less than 10 μsec and with a large signal number (150 Hertz). The source of the generator power is a pulsed magnetron. Tests showed that the generator operates satisfactorily with an off-duty factor of 800, maintaining all basic use parameters, which are given in a table for 200 hr of continuous operation. (INIS)

6894 KILOTON SHIELD DOORS AT LAMPF. Wilson, M. T. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 428-429(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6895 EASY WAY OF IMPROVING THE FLATNESS OF THE RADIATION FROM A LINEAR ACCELERATOR. Fry, W. H.; Huerta, R. H.; Schirmer, M. B. (Latter-Day Saints Hospital, Salt Lake City). Acta Radiol., Ther., Phys., Biol.; 12: No. 3, 397-400(1973).

A simple procedure is described whereby the flatness of the radiation from a linear accelerator may be improved without difficult operations on the flattening filter. This is done by means of an auxiliary (or "shimming" filter). Alterations to the auxiliary filter are easily made and checked experimentally; the technique could be applied to energies other than the one investigated. (auth)

6896 POWER SUPPLIES FOR THE KEK 500 MeV BOOSTER MAGNET. Takikawa, K. (National Lab. for High Energy Physics, Oho, Japan); Tsukahara, T.; Uesugi, T. Fuji Jiho; 46: No. 12, 984-986(Dec 1973). (In Japanese).

The outline of power supply system is given, which is used for the 500 MeV proton synchrotron booster for the 8 GeV proton synchrotron at the National Laboratory for High Energy Physics. The system consists of high voltage incoming panel, pulse source, bias source, and energy accumulation choke. Main circuit is briefly explained. The key point is to supply uniform current for each magnet. In the second part, the specifications of the 20 Hz pulse source are given together with detailed description on main circuit and control device. Pulse source circuit and the waveform of voltage and current are shown. The block diagram of the control device is also presented. In the third part, the specifications and short description of the bias source are given. Finally, the outline of the choke coil is given. The measured values of resistance, self inductance and coupling constant are presented. It is also reported that the performance of this power supply system is as expected. (tr-auth)

6897 500 MeV BOOSTER SYNCHROTRON MAGNET OF NATIONAL LABORATORY FOR HIGH ENERGY PHYSICS (KEK). Sasaki, H. (National Lab. for High Energy Physics, Oho, Japan); Kuno, T.; Watanabe, I.; Imasaka, Y.; Inagawa, K. Fuji Jiho; 46: No. 12, 978-983(Dec 1973). (In Japanese).

An 8 GeV proton synchrotron is being built at National Laboratory for High Energy Physics in Tsukuba. The design and construction of a 500 MeV booster synchrotron magnet used for that proton synchrotron are described. The diameter of the booster synchrotron is 12 m, and consists of 8 unit magnets which are excited so that 6.5 k Gauss direct current magnetic field is superposed with 20 Hz, 4.5 k Gauss sinusoidal magnetic field. The magnetic field distribution is based on combined A.G. (alternating gradient) principle. The iron core of the magnets was made from 0.35 mm thick plates, and is cooled by natural circulation of air.

The processes of manufacturing the iron core are described in detail with emphasis on machining precision. The processes of making pancake exciting coils are also described together with various tests performed. Finally, the processes of assembling the total booster system are described in detail together with various methods for fine adjustment employed. The components of the booster and machining tools used are also shown. (JA)

6898 CURRENT AND ENERGY LOSSES OF ELECTRONS IN TITANIUM FOILS. Tabata, T.; Ito, R. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 27-34(1974).

In order to estimate the current and energy losses of the electron beam in the accelerator window consisting of titanium foil, empirical relations to express the number transmission coefficient η_{TN} (x) and the average fractional energy $T_{av}(x)/T_0$ of transmitted electrons as a function of foil thickness x have been examined. For $\eta_{TN}(x)$, the equation proposed by Rao has been found to give a better fit to the experimental data in the energy region 0.2 to 2 MeV than the equation used by Makhov and by many other authors. A modification of Rao's equation has been made to improve the fit at the tail of the transmission curve, and the modified equation has been used to calculate the fractional current loss $f_c(x)$ of the electron beam in titanium foils. For $T_{av}(x)/T_0$, the equation recently developed by the present authors in formulating the energy deposition algorithm has been found to show a rather good agreement with the experimental data in the energy region 0.2 to 0.4 MeV. This equation has been used to calculate the fractional energy loss $f_e(x)$ of the electron beam in titanium foils. Tables of the values of $f_c(x)$, $f_e(x)$, and the fractional power loss $f_p(x)$ calculated from them are given for $10 \leq x \leq 50$ μm and for incident energies 0.1 to 3 MeV. (auth)

6899 COMPLEX PROBE FOR INVESTIGATING PULSED HIGH-CURRENT ELECTRON BEAMS. Koroteev, V. I.; Shishko, A. S. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Irkutsk, USSR). Instrum. Exp. Tech. (USSR). (Engl. Transl.); 17: No. 3, 663-666(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 35-38(1974).

In order to investigate the time and space aprameters of high-current beams of relativistic electrons a complex probe has been proposed containing systems of current, charge, and calorimetric sensors. The working order of the probe is checked for an electron energy of up to 5 MeV and an energy density of up to 25 J/cm^2 for the beam incident on the probe surface. The time resolution for measurement of the current characteristics of the beams extends down to 10^{-9} sec. The probe can operate in a plasma volume during the study of the interaction of beams of relativistic electrons with a plasma. (auth)

6900 METER FOR MEASURING THE AVERAGE CURRENT IN A PULSED BEAM OF CHARGED PARTICLES BY MEANS OF A MAGNETOINDUCTIVE SENSOR OPERATING IN AN OSCILLATORY MODE. Flekkel, M. B. Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 673-675(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 44-46(1974).

The parameters, the electrical schematic, and the structural peculiarities of a meter which measures the average current of a pulsed beam of charged particles by means of a magnetoinductive sensor operating in an oscillatory mode are described. A procedure is given for choosing the tuned frequency and Q of the tuned circuit of the sensor. (auth)

6901 VACUUM PATH OF LINEAR ELECTRON ACCELERATORS AND HIGH-FREQUENCY SEPARATORS. Prudnikov, I. A.; Ryabov, V. V.; Saksaganskii, G. L.; Smirnov, V. L. (Scientific-Research Inst. of Electrophysical Equipment, Leningrad). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 637-641(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 13-16(1974).

Engineering methods of calculating the vacuum parameters of structures of the "irised waveguide" type are considered, as well as the most reasonable versions of the layout of the vacuum systems of linear accelerators and the technology of fabricating the irised waveguides. The parameters of linear accelerators developed in the Scientific-Research Institute of Electrophysical Equipment are presented, including the principal vacuum characteristics. The possibility is demonstrated of creating a sealed accelerating system for linear electron accelerators with built-in nonsputtering getters. (auth)

Ion Sources and Injection and Extraction Systems

Refer also to abstract 7157.

6902 (JINR-P9-8038) PRODUCTION OF ELECTRON BUNCHES WITH A CIRCULAR CROSS SECTION. Stepanov, A. D.; Ivanov, G. A.; Golubev, I. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1974. 22p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

A method is described for obtaining electron bunches with a circular cross section in the crossed fields of an electron beam of the magnetic type of cylindrical geometry. The electric or magnetic field (or both) vary with time in the region of the cathode creating conditions for the extraction of the electrons in the drift space at given time intervals. With a rate of change of the electric field of 2×10^{11} V/cm · sec, a bunch with a duration of 2.5×10^{-9} sec was obtained with a longitudinal velocity in the cathode region of $\leq 2 \times 10^7$ m/sec. In the drift region the longitudinal dimension of the bunch is shortened by a factor of three by means of a jump of the magnetic fields. (tr-auth)

6903 (KFTI-73-24, pp 11-12) PRELIMINARY INVESTIGATION OF A HIGH-ENERGY INJECTOR. Vishnyakov, V. A.; Grishaev, I. A.; Rudenko, A. P.; Rudychev, V. G.; Fursov, G. L. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

A high-energy injector accelerator is described, which, because of its characteristics, may be used as injector of a linear accelerator with 2 GeV energy. The accelerator was constructed and used in preliminary tests. Its experimental characteristics are given. (INIS)

6904 (KFTI-73-24, pp 13-16) THE CHOICE OF AN INJECTION OPTIMAL SCHEME OF THE HIGH-CURRENT LINEAR ACCELERATOR. Gudkov, V. I.; Svistunov, Yu. A. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

In the use of a linear accelerator as an injector in an electron synchrotron it is often desirable to have, at the accelerator exit, a beam of particles with a small energy spread. In such cases it is very important to have a preliminary bunching of accelerator particles. Motion of electrons in the injector is calculated. Here the pre-bunching is a cut-off of iris waveguides. (INIS)

6905 FERRITE DEFLECTOR OF A B-3M SYNCHROTRON. Lysenko, A. P.; Mikhalichenko, A. A.; Turkin, V. F. (Inst. of Nuclear Physics, Novosibirsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 653-654(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 26-27(1974).

The construction of a deflector with a ferrite filler which performs one-revolution extraction of electrons from the B-3M synchrotron at an energy of 250 MeV (radius ~1 m) is described. (auth)

Ion Optics and Field Calculations

6906 (AD-779660) EQUILIBRIUM AND STABILITY OF FLOWS IN ACED-TYPE ACCELERATORS. Morozov, A. I. 18 Apr 1974. Translated by R. E. Zarza from pp 85-92 of Plazmennye Uskoriteli, 1973. 18p. NTIS $3.00.

6907 (BNL-19329) OBSERVABLES WITH LINEARLY COUPLED OSCILLATORS. Chao, A. W.; Month, M. (Brookhaven National Lab., Upton, N. Y. (USA)). 12 Aug 1974. 24p. Dep. NTIS $4.25.

The theory of linear coupled oscillators as it relates to a synchrotron or storage ring is reviewed and extended. A correspondence is made between certain derived variables and physical observables. Considered in particular are the beam envelope, the filtered response to the excitation of a coherent betatron oscillation, and the influence on the transverse beam shape (i.e. the two-dimensional transverse density distribution). (auth)

6908 (JINR-D9-8076) PROBLEM OF THE CALCULATION OF TWO-DIMENSIONAL ELECTROSTATIC FIELDS. Dmitrievskii, V. P.; Kol'ga, V. V.; Treibal, Z. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The method for calculating two-dimensional electrostatic fields with respect to the beam extraction systems of the cyclic accelerators has been considered. (auth)

6909 (JINR-P9-8119) CALCULATION OF THE CAPTURE OF MULTI-CHARGED IONS IN HEAVY ION ACCELERATORS.

Iovnovich, M. L.; Kuznetsov, A. B.; Preizendorf, V. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of New Acceleration Methods). 1974. 17p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

On the basis of new data on the ionization cross section, the capture of multiply charged ions of a series of elements in the electron ring of a collective accelerator is calculated. The question of the avalanche loss of ions during acceleration is examined. The threshold charge size of the ions which is retained during acceleration before avalanche loss is determined. (tr-auth)

6910 (KFTI-73-24, pp 21) ON CRITICAL CURRENTS IN A SINGLE RESONATOR SECTION. Grishaev, I. A.; Gorokhovatskij, F. S.; Zykov, A. I.; Kramskoj, G. D.; Mondrus, I. N.; Fursov, G. L. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

It was shown that in an individual section of a linear accelerator, the charge is kept at critical currents significantly above threshold, and at threshold values the beam intensity increases with increase in the pulse duration, i.e., the average critical current should approach threshold values with increase in duration. Studies of such dependence in the individual resonator, 441 cm long, without radiofrequency power are described. (INIS)

6911 (KFTI-73-24, pp 23-24) TRANSIENT PROCESSES AT AN ACCELERATING FIELD EXCITATION IN THE DIAPHRAGM-TYPE WAVEGUIDE. Gusarov, V. N.; Shal'nov, A. V. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Results are presented of precise calculations of the distribution of high-frequency pulses along an iris waveguide, obtained with consideration of dispersion effects due to non-monochromaticity of the signal resulting from final prolongation of the pulse. (tr-auth)

6912 (KFTI-73-24, pp 25-27) ELECTRON BUNCH MOTION IN SPACE CHARGE FIELD. Bavin, V. B.; Vetsko, V. M.; Lejtan, V. A.; Roshal', A. S.; Shal'nov, A. V. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

In calculations on high-energy electron and ion accelerators, it is necessary to study the effect of space-charge forces on particle movement. Movement of an electron cluster in its own Coulomb field was studied. Leakage in the transverse direction obstructs the homogeneous longitudinal magnetic field. The method of numerical modeling on an electronic computer can be used to estimate the energy scatter, increase in length, and radial dispersion due to movement of the beam in the system of cluster formation or between accelerator sections. (INIS)

6913 (KFTI-73-24, pp 28-29) THE POSSIBILITIES OF ELECTRON BUNCH CREATION WITH SMALL PHASE EXTENSION. Rudychev, V. G. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The problem of obtaining small-phase-width electron clusters in an accelerator with a given structure was studied by using modulation of injected beam of electrons, according to energy, without preliminary bunching. The LU-20 (20-MeV linear accelerator) was used with gradual change in phase velocity and field voltage. (INIS)

6914 (KFTI-73-24, pp 30-31) OPTIMIZATION OF THE PREBUNCHER PARAMETERS OF THE ELECTRON ACCELERATORS. Rudychev, V. G. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

A comparatively simple and efficient method of decreasing the scatter and phase width of a cluster in an electron accelerator is with the use of a resonator-buncher. The problem of selecting the properties of the buncher (i.e., the modulation energy and the drift length) was studied, starting with conditions of minimum phase width of the electron cluster, in the sense of the smallest quadrature. The results of numerical calculations are presented, taking into account the effect of Coulomb interaction on the bunching process. (INIS)

6915 (KFTI-73-24, pp 35-37) THEORY OF ACCELERATING FIELDS PRODUCTION WITH FREE PRECESSION OF MAGNETIC MOMENT IN FERRITES. Rakityanskij, A. A.; Shenderovich, Am. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The possibility has been considered of making a high-energy accelerator in which the accelerating field is formed by free precession of the magnetic moment of ferrite magnetized to saturation around a vector of the magnetic field. In the present study the theoretical basis of the method is examined. (INIS)

6916 (KFTI-73-24, pp 38-39) EXPERIMENTAL INVESTIGATION OF FREE PRECESSION IN FERRITES, INDUCED BY PULSE MAGNETIC FIELD. Rakityanskij, A. A.; Shenderovich, A. M. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

A method of making accelerator fields by activation by free precession in ferrite magnetized to saturation is studied. In the study an experimental investigation was made of the processes that occur in this. (INIS)

6917 (KFTI-73-24, pp 87-88) ON THE CYLINDRICAL SURFACE WAVES EXCITATION IN PLASMA BY RELATIVISTIC ELECTRON FLOW. Naugol'nyj, N. N.; Shendrik, V. A. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Slow surface waves can be propagated along a plane plasma-vacuum boundary. These waves may interact with charged particles moving close to the boundary with a velocity close to the wave phase velocity, and this may be used to generate and enhance electromagnetic waves. The interaction of the confined electron beam with an unconfined isotope plasma was studied. A model is proposed for the charged particle storage ring and accelerator where the metal chamber plays the role of the plasma. (INIS)

6918 (KFTI-73-24, pp 99-102) ON THE INDUCED PROCESSES EFFECT ON PHASE MOTION OF RELATIVISTIC ELECTRON BUNCH IN SYNCHROTRON. Naigol'nyj, N. N. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

In cyclic accelerators, along with spontaneous magnetobremsstrahlung there is an effect on electron dynamics and possibly a radiation-induced transition or absorption of photon charges due to the effect of a field of surrounding particles. Because of the non-equivalence of the electron quantum levels, induced processes should change the classical radiation losses which basically determine the decrement in different types of oscillations. In most cases of practical interest for the dynamics of accelerators these changes are relatively small. However, the fluctuations in induced processes may be accompanied by activation of the amplitude of fortuitous oscillations, which are considered here. (INIS)

6919 (UCID-16128) RF EMISSION IN THE BUNCHER RING. Moses, K. G.; Wright, D. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Sep 1972. Contract W-7405-eng-48. 13p. Dep. NTIS $4.00.

The experimental study of the rf noise on the unmodulated electron beam pulse and its growth as a result of interaction of the beam with the buncher system has reached the point where we are able to make some rough quantitative statements. The present status of this investigation is reported. (auth)

6920 (UCID-16201) NOTE ON BALANCED FLOW BEAM TRANSPORT. Beal, J. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Jan 1973. Contract W-7405-eng-48. 8p. Dep. NTIS $4.00.

The conditions for space-charge balanced flow for beams with finite emittance are reviewed. The forces acting on a beam, i.e., space charge, Lorentz (magnetic) and emittance, can be made to balance and thereby produce a smooth beam. This method of beam transport is relevant to the long solenoid transport system on the Astron linear accelerator and also beam compression work associated with the Beam Research Program at LLL. (auth)

6921 RADIATION IN CYLINDRICAL RESONATOR FROM LINEAR BUNCH WITH ARBITRARY DISTRIBUTION OF CHARGE. Serov, V. A.; Nagorskii, G. A. Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 8: No. 5, 326-330(1973). (In Russian).

In the approximation of given currents the problem of excitation of cylindrical resonators by thread-like bunches of particles with arbitrary distribution of charge density inside is considered. The radiation field is presented as a set of natural oscillation modes of solenoidal type. The formulas describing the energetic distribution of particles inside the bunch and integral losses of energy by the bunch for the arbitrary mode are obtained. Some results of numerical calculations for the relativistic bunches with uniform and sinusoidal distribution of the charge are given. (auth)

6922 BEAM CURRENT LOSSES IN RACE TRACK MICROTRON. Asgekar, V. B.; Bhalla, R. K.; Bhiday, M. R.; Bhoraskar, V. N. (Univ., Poona). Indian J. Pure Appl. Phys.; 12: No. 3, 237-238(Mar 1974).

In the design of a 10-MeV race track microtron, the velocity correction is applied to calculate the field free space for the first few orbits in which the electrons are nonrelativistic. It is shown that most of the beam current is lost due to the neglect of this correction. Further, it is found that the condition for phase stability is unaffected by cutting the pole pieces in accordance with the velocity correction. (auth)

6923 ISOCHRONISM OF THE SECTOR MAGNETIC FIELD OF A CYCLOTRON. Katsaurov, L. N. Kratk. Soobshch. Fiz.; No. 3, 3-7(1974). (In Russian).

The isochromism of the sector magnetic field was studied on the Mir I computer as a function of the dimensions and geometrical placement of the sectors. The results indicated that the ampere turns of the corrective windings can be decreased by a factor of 5. (tr-auth)

6924 FILAMENT MODEL FOR A STATIONARY FIELD ELECTRON RING ACCELERATOR: THE GENERALIZED BERNSTEIN–GREENE–KRUSKAL PROBLEM. Ehrman, J. B. (Univ. of Western Ontario, London). J. Plasma Phys.; 12: No. 2, 233-269(Oct 1974).

The longitudinal behavior of the electron ion ring in a stationary electron ring accelerator (ERA) is studied by means of a filament model which neglects the radial thickness of the ring. There are two widely different time scales (short or STS of the order of a bounce time in the ring, and long or LTS) that characterize the system. The Vlasov equations for a system which is stationary on the STS can be solved in the ion-pickup region by an approximation in which each species of particle essentially sees only a potential well formed by the other species. This gives a generalization of the classical Bernstein–Greene–Kruskal (BGK) problem, in which both species move in the same potential. The conditions under which this generalized BGK problem is well defined are given, and broad classes of quasi-equilibria (i.e., equilibria on the STS) are obtained. The time dependence on the LTS of some of these quasi-equilibria is then obtained by invoking charge conservation, momentum conservation and the adiabatic invariance of longitudinal action integrals. The stability of these quasi-equilibria (i.e., their behaviour under time-dependent perturbations on the STS) is deferred to a subsequent paper. (auth)

6925 CALCULATION OF NONREGULAR WAVE GUIDE CHARACTERISTICS OF THE SYNCHRONOUS INTERACTION OF BEAM CURRENT WITH TRAVELLING ELECTROMAGNETIC WAVE. Movsisyan, L. M.; Avetisyan, Yu. O. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 8: No. 5, 377-380 (1973). (In Russian).

The process of synchronous interaction of the beam current with the travelling electromagnetic wave along the axis of a nonregular waveguide is investigated. The conductivity of the waveguide satisfying certain characteristic laws at synchronous interaction of outside field (generation field), synchronous field, and the acting field variation is found. (auth)

6926 SUPERCONDUCTING QUADRUPOLE MAGNETIC LENS WITH AN APERTURE OF 30 mm. Geraskin, E. V.; Grebinnik, V. G.; Zhukov, V. A.; Malyaev, V. Kh.; Manych, A. P.; Selivanov, G. I. (Joint Inst. for Nuclear Research Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 649-652(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 23-25(1974).

Results are presented for an investigation on a test sample of a superconducting quadrupole magnetic lens module having cylindrical poles, which is designed for the focusing of hyperon beams. The lens aperture is 3 cm, and the maximum field is 16 kG. At distances $r \leq 1.2$ cm from the lens axis the maximum magnitude of the magnetic field gradient is 12 kG/cm, while the nonlinearity is below 1%. The effective length of the lens is calculated from the measured shape of the curve for the decay of the field in the fringing region. (auth)

Storage Rings

Refer also to abstract 7230.

6927 (KFTI-73-24, pp 73-76) THE RESULTS OF BEAM INTENSITY INCREASING IN THE FTI AN UKRAINIAN SSR STORAGE RING. Grigor'ev, Yu. N.; Grishaev, I. A.; Koba, I. I.; Kononenko, S. G.; Mocheshnikov, N. I.; Rakityanskij, A. A.; Reprintsev, L. V.; Tarasenko, A. S.; Terekhov, B. A.; Tkachenko, V. D.; Tolstoj, A. E.; Shenderovich, A. M. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Recent improvements made in the particle storage system at the UkrSSR Academy of Sciences FTI have allowed study of the beam in the range of high values of stored current—up to 650 mA. The results indicate that increasing the beam intensity in the accumulator is accompanied by scatter of particles according to energy, determined from measurements of extended bunch dimensions, 2 to 2.5 times less than calculated. Study of life time of the beam and its transverse dimensions with significant increase in particle density of the bunch ($\sim 10^{10}$ cm^{-3}) showed that ions of the residual gas do not affect the beam properties if the operating current of the accumulator is sufficiently removed from the resonances. (INIS)

6928 (KFTI-73-24, pp 77-80) THE CALCULATION OF THE COLLECTIVE EFFECTS IN THE FTI AN UKRAINIAN SSR ELECTRON STORAGE RING (TRANSVERSE MOVEMENT). Kononenko, S. G.; Shenderovich, A. M. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

In the electron storage ring at the UkrSSR Academy of Sciences Physico-Technical Institute, currents of hundredths of a milliampere were obtained. These values are affected by collective effects, which are the basic factors limiting further current increase. Tests were made to evaluate these effects. The results indicated that the most serious are wall and resonance instabilities. However, their thresholds are strongly dependent on the dimensions of the bunch and nonlinearity of the magnetic field. Corresponding increases in the dimensions and nonlinearity of the field increase these thresholds. Congruent and noncongruent shifts of betatron particles are much less serious since they may appear at currents of hundredths of an ampere depending on the degree of compensation of the space charge of the ion beam. (INIS)

6929 (KFTI-73-24, pp 81-84) THE CALCULATION OF THE COLLECTIVE EFFECTS IN THE FTI AN UKRAINIAN SSR ELECTRON STORAGE (LONGITUDINAL MOVEMENT). Kononenko, S. G.; Shenderovich, A. M. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Studies were made on collective effects due to high intensity of the current in the electron accumulator of the UkrSSR Academy of Sciences Physico-Technological Institute. Evaluation of the effect of the space charge, of the effect of scattering of particles inside the bunch on each other, and an increase in extended measurements of the beam to the value of the accumulator and beam stability are presented. (INIS)

6930 (KFTI-73-24, pp 85-86) ON THE RESIDUAL GAS ION EFFECT ON PARAMETERS OF THE STORED ELECTRON BEAM. Grigor'ev, Yu. N. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In Nuclear science and engineering problems. Ser. High Energy physics and nuclear physics.

Problems were examined concerning the effect of ions of residual gas on the properties of the stored electron beam. Experimentally, no increase in transverse dimensions of the beam or decrease in life time was observed, which results from theoretical calculations. This is explained by the fact that study of the problem of ion accumulation usually does not take into consideration the elastic dispersion of atoms and ions of the residual gas by the electrons in the beam. The effect on the storage of the ions of the residual gas may indicate a multiple elastic scattering of neutral atoms since there is no holding force in the beam region. This results in a decrease in the inleakage of neutral particles into the beam. (INIS)

6931 (KFTI-73-24, pp 89-90) ON THE LUMINOSITY OF THE COLLIDING RANGE OF ELECTRON AND POSITRON BEAMS IN STORAGE RINGS. Grigor'ev, Yu. N; Grishaev, I. A. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The effectiveness of the range of impact of relativistic electrons and positron beams of homogeneous intensity and geometrical dimensions in storage rings is characterized by "luminosity." It is considered that the established dimensions do not depend clearly on the time and are generally determined by the averaged characteristics of the focusing of the storage ring. (INIS)

6932 (KFTI-73-24, pp 91) ON THE DEPRESSION OF LONGITUDINAL BEAM INSTABILITY BY RESONANCES OF SYNCHROTRON OSCILLATIONS. Kononenko, S. G.; Shenderovich, A. M. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

In the storage ring at the Ukr SSR Academy of Sciences Physico-Technological Institute, the effect of depression of the longitudinal instability of the beam due to the resonances of the synchrotron waves was determined experimentally. The depression is due to an increase in the nonlinearity of the synchrotron waves in resonance and thus to an increase in the Landau damping action. In the case of parametric resonance, stabilization of the instability may occur also as a phenomenon of a stable stationary wave with zero amplitude. (tr-auth)

6933 (KFTI-73-24, pp 92-94) ON THE BEAM CONTROL POSSIBILITIES BY MEANS OF STOCHASTIC SHF VOLTAGE IN STORAGE RINGS. Adejshvili, D. I.; Bulyak, E. V.; Kozin, V. P.; Mocheshnikov, N. I.; Tolstoj, A. E. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The possibility of using a noise ultrahigh-frequency field of the nonresonance type for controlling the limit of instability of the beam was investigated. The results indicated the possibility of flexible control by the threshold of current instabilities, radial widening of the beam using its "fitting" on a peripheral target, and continuous output of a secondary radiation, and widening of the beam for subsequent output of e^-, e^+ with the use of an output channel. (INIS)

6934 (KFTI-73-24, pp 95-96) ELECTRON LINEAR ACCELERATOR-STORAGE RING SYSTEM. Some Results and Perspectives. Adejshvili, D. I.; Bulyak, E. V.; Grishaev, I. A.; Kozin, V. P.; Mocheshnikov, N. I.; Tolstoj, A. E. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The possibilities of the linear electron accelerator–storage ring system are briefly characterized from the viewpoint of forming and using primary and secondary beams, and work is cited which has been completed, started, or proposed. Graphs and diagrams are included. (INIS)

6935 (KFTI-73-24, pp 103-104) ON FORM OF SYNCHROTRON RADIATION LINE IN STORAGE RING. Mazmanishvili, A. S. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

Previous studies on the quantum state of the "classical" electron field in the storage ring have indicated that the structure of the K harmonic radiation of a uniformly converted relativistic electron has a δ-type nature. The effect of stochastic duration of the frequency of rotation of the electron bunch on the line structure of the synchrotron radiation was studied. (INIS)

Experimental Facilities

Refer also to abstracts 6072, 6306, 6351, and 7448.

6936 (CEA-CONF-2632) CAMAC ORIENTED PROGRAM FOR DATA ACQUISITION AND PROCESSING WITH A SOPHISTICATED PDP15 SYSTEM. Bianchi, G.; Genin, J. P. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire). [nd]. 4p. (CONF-7309128-1). Dep. NTIS (US Sales Only) $4.00.

From DECUS proceedings; London, UK (19 Sep 1973).

A program was developed for a PDP15 with a CAMAC interface to handle and process data delivered by the ADC's, the pattern-units, and the scalers involved in nuclear physics experiments at the Saclay 600 MeV linac. The main characteristics of the software are: (1) a CAMAC device handler; (2) an interactive module to be used for definition of acquisition parameters or/and processing parameters; and (3) a module which is responsible for controlling peripheral equipment such as magtapes and graphic 15 display unit for output, or such as teletype, graphic 15 keyboard or CAMAC device for input while computations are under work. (auth)

6937 THE PION BEAM (π^-) FOR BIOLOGICAL AND MEDICAL USES AT THE SWISS INSTITUTE FOR NUCLEAR RESEARCH (SIN). Haefeli, P. (Schweizerisches Inst. fuer Nuklearforschung, Villigen; Kantonsspital Zurich (Switzerland). Strahlenabteilung). Fortschr. Geb. Roentgenstr. Nuklearmed.; 121: No. 1, 101-105(Jul 1974). (In German).

3 figs.; 1 ref.

The Swiss Institute for Nuclear Research (SIN) operates a cyclotron for the production of 70 MeV protons (maximum energy). When this beam is made to hit a target, pions are produced which can be used with the help of magnetic lenses as secondary beam for biological and medical experiments. (GE)

6938 DOSIMETRY PLANNING AT THE PION BEAM πE3 AS A PREPARATION FOR BIOLOGICAL EXPERIMENTS AND MEDICAL APPLICATIONS. Blattmann, H.; Cabeza, L.; Riehle, L. (Zurich Univ. (Switzerland). Strahlenbiologisches Inst.); Haefeli, P. (Kantonsspital Zurich (Switzerland). Strahlenabteilung); Mueller-Duysing, W. (Stadtspital Triemli, Zurich (Switzerland). Klinik fuer Nuklearmedizin und Radiotherapie). Fortschr. Geb. Roentgenstr. Nuklearmed.; 121: No. 1, 105-108(Jul 1974). (In German).

1 fig.; 7 refs.

The paper informs potential users on planning and preliminary work in the dosimetry with negative pions from the πE3 beam of the SIN by giving details about the beam parameters to be controlled and the chosen dosimetry system. (GE)

6939 14-MeV NEUTRON COLLIMATOR DESIGN FOR CANCER THERAPY. Allen, E. J. (Oak Ridge National Lab., TN); Maynard, C. W. Trans. Amer. Nucl. Soc.; 19: 48(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6940 NEUTRON-BEAM DOSIMETRY CONTROL SYSTEM. Surratt, R. E. (Naval Research Lab., Washington, DC); Gordon, S. E.; Attix, F. H.; Bondelid, R. O.; Theus, R. B.; Rogers, C. C. (Naval Research Lab., Washington, DC). Trans. Amer. Nucl. Soc.; 19: 50-51(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6941 NEUTRON PRODUCTION BY ELECTRON ACCELERATORS. Gozani, T. (Intelcom Rad Tech., San Diego, CA). Trans. Amer. Nucl. Soc.; 19: 63(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

6942 NEUTRON LOGGING. Sherman, H. R.; Tittman, J. (To Schlumberger Canada Ltd.). Canadian Patent 954,638. 10 Sep 1974.

According to one embodiment of the invention an epithermal neutron sidewall well logging tool is provided with a fast neutron scattering shield shaped to accommodate a neutron source and supported by a housing to scatter back fast neutrons from the source toward earth formation adjacent the housing; preferably this shield defines a cavity asymmetrically formed therin to enclose said source in a position proximate an earth formation toward which the housing may be biased. (CA)

6943 EXPERIMENTAL STUDY OF COLD NEUTRON GAIN USING AN ELECTRON LINAC. Inoue, K.; Otomo, N.; Iwasa, H. (Hokkaido Univ., Sapporo). Hokkaido Daigaku Kogakubu Kenkyu Hokoku; No. 70, 49-61(Feb 1974). (In Japanese).

Neutron time-of-flight experiments using an electron LINAC were performed to obtain data for the optimum design of a pulsed cold neutron source assembly. Cold neutron gain factors for several cold moderators were measured at various temperatures. This investigation showed that very cold solid methane is a favor-

able moderator material for the pulsed cold neutron source. (auth)

6944 BASIC ECONOMIC EFFICIENCY INDICATORS OF FACILITIES WITH ELECTRON ACCELERATORS TO PERFORM RADIATION-CHEMICAL PROCESSES. Nikulin, K. I.; Breger, A. Kh.; Kozlov, Yu. D.; Chepel, L. V. At. Energ. (USSR); 37: No. 3, 234-238(Sep 1974). (In Russian).

A method of calculating the economic efficiency of radiation-chemical facilities with electron accelerators is described. By means of this method, economic indicators of three facilities to perform radiation-chemical processes were obtained and the possibility of industrial utilization of electron accelerators in these processes evaluated. (29 references) (auth)

6945 REPORT ON THE APPLICATION OF SYNCHROTRON RADIATION TO LOW-ANGLE SCATTERING. Barrington Leigh, J.; Rosenbaum, G. (Max-Planck-Institut fuer Medizinische Forschung, Heidelberg). J. Appl. Crystallogr.; 7: No. 2, 117-121 (1 Apr 1974).

From 3rd international conference on small-angle scattering; Grenoble, France (4 Sep 1973).

The use of synchrotron radiation as an intense x-ray source for biological diffraction has only very recently been promoted into a long-term experimental programme. Some general and some detailed aspects of this development are reported. In the case of small-angle studies on weakly scattering specimens at high time resolution, e.g., stroboscopic diffraction studies on muscle, the lack of x-ray sources of considerably higher brightness than from conventional x-ray generators has become limiting. As it has become technically impossible to pursue the development of rotating-anode tubes much further, the use of an electron synchrotron or storage ring with 100 to 1000 times higher brightness opens up the possibility not only of collecting much improved data but also of whole new ranges of experiments. A brief description is presented of the low-angle diffraction equipment currently in use at the synchrotron in Hamburg. (auth)

6946 PREPARATION FOR PHYSICS AT THE SPS. CERN Cour.; 14: No. 11, 379-382(Nov 1974).

The experimental areas and beam lines which will be fed by the CERN 400 GeV proton synchrotron are described, and some of the experiments planned for the initial physics program are outlined. (WHK)

6947 LIQUID HELIUM CRYOSTAT FOR OPTICAL AND ELECTRICAL STUDIES OF ELECTRON-IRRADIATION EFFECTS ON SOLIDS. Oka, T.; Yoshida, T.; Shono, Y.; Kitagawa, M. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 48-50(1973).

A simple liquid helium cryostat to study irradiation effects of the energetic electrons on solids is described. It permits to irradiate samples and to measure the optical and electrical properties under and after irradiation near and above liquid helium temperature. An experimental result concerning the thermally stimulated current of a CdS single crystal before and after irradiation is also reported as a typical use of the cryostat. (auth)

6948 PARAMETERS OF THE SYNCHROTRON BEAM OF THE EREVAN ELECTRON ACCELERATOR IN THE X-RAY RANGE OF THE WAVELENGTHS. Alikhanyan, A. I.; Avakyan, Ts. M.; Bezirganyan, P. A.; Karabekov, I. P.; Martirosyan, M. A.; Kotsinyan, A. M.; Ovakimyan, S. S. (Erevan State Univ.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 667-670 (1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 39-42(1974).

Results are presented of the measurement of the absolute number of photons in the range of wavelengths 0.6 to 2 Å radiated by an accelerated beam per second in a unit energy interval and in a unit solid angle. The divergence of the beam in the vertical plane and the density distribution in the beam cross section are determined. The computation material is presented which allows estimation of the intensity of the radiation in a wider interval of wavelengths. (auth)

6949 SYSTEMS OF COUNTERS IN THE CAMAC STANDARD. Zhuravlev, N. I.; Nguyen Man Shat; Sidorov, V. T.; Sinaev, A. N.; Stakhin, A. A.; Stakhin, A. A.; Churin, I. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 728-730(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 91-93(1974).

The operation of a system of counters implemented in the CAMAC standard is described. The system occupies one casing. It includes binary counters with a maximum counting frequency of 25 and 150 MHz, registers for stipulating constants by means of switches, a counter timer with exposure setting, a block for external control of the operation of the casing, and a controller with fixed programs for sequential reading of information from all of the devices and transmitting of information to an electronic computer. The operation of the controller begins on command from the counter-timer. The system is used in experiments on the JINR synchrocyclotron. (auth)

6950 NEUTRON GENERATOR HAVING A TARGET ON WHICH A BEAM OF HYDROGEN IONS IS INCIDENT. Reifenschweiler, O. (to U. S. Philips Corp.). US Patent 3,836,785. 17 Sep 1974. Priority Date 15 Jul 1970, Netherlands. 6p.

A target for a neutron generator having a surface formed of a plurality of V-shaped funnels or grooves with edges coinciding at an acute angle for reducing sputtering of the reaction layer by the hydrogen ions incident upon the target surface, is described. (10 Claims, 4 Drawing Figures) (Official Gazette)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

6951 CONCEPTS OF CONTEMPORARY ASTRONOMY. Hodge, P. W. New York; McGraw-Hill Book Company (1974). 552p. $9.95.

This textbook is intended as an introduction to the concepts of modern astronomy for liberal arts students. It was designed for use with a one-semester or one-quarter course. (WDM)

Cosmic Radiation

Refer also to abstracts 6080, 6137, 7039, 7156, and 7158.

6952 COSMIC-RAY PROPAGATION AND MODULATION IN THE INTERPLANETARY MEDIUM. Gleeson, L. J. (Monash Univ., Clayton, Australia). pp 79-107 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

An attempt is made to show the present state of the observations and theories relevant to the modulation within the solar cavity of galactic cosmic rays with kinetic energies in the range 10 MeV to 10 GeV. In particular it is shown that the modulation of electrons, protons, and helium nuclei over the last half-solar-cycle can well be reproduced with current models, and the radial gradients and anisotropies associated with these models are shown. The origin within the energy spectrum of the low-energy particles and their properties is discussed, as well as the verification of energy loss processes. (IAA)

6953 INVALIDITY OF STANDARD PERTURBATION TECHNIQUES IN COSMIC RAY TRANSPORT THEORY. Kaiser, T. B. (Univ. of Maryland, College Park); Birmingham, T. J.; Jones, F. C. pp 485-491 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

It is contended that the existence of particles with arbitrarily long correlation times invalidates the condition necessary for the applicability of standard perturbation techniques in cosmic-ray transport theory. It is also argued that Klimas and Sandri's (1971) conclusion about a non-Markovian time development of the particle distribution is unwarranted. (IAA)

6954 CRITICAL REVIEW OF RECENT WORK IN COSMIC RAY TRANSPORT THEORY. Klimas, A. J.; Sandri, G. (Aeronautical Research Associated of Princeton, Inc., NJ). pp 493-513 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

The physical parameters of cosmic-ray transport are considered, taking into account three dimensionless parameters which are contained in the equations for the cosmic rays. Only two of these parameters are independent. The quasi-linear truncation states that over the short time period during which a "collision" with the random field takes place the actual particle trajectory is approximated by the helical trajectory the particle would have in the presence of the mean field alone. Questions concerning the application of this approximation are discussed together with the use of the adiabatic approximation. (IAA)

6955 COSMIC RAY INTENSITY VARIATIONS OF AUGUST 1972. Mathews, T. (Univ. of Calgary, Alberta). pp 697-701 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Some of the most remarkable solar activity and cosmic-ray intensity variations of the current solar cycle were recorded in the first two weeks of August 1972. The complexity of the observed variations is comparable to or even exceeding those of July 1959 and November 1960. The rapid succession of the flares makes it rather difficult to attribute details of the observed cosmic-ray variations to individual flares unambiguously. (IAA)

6956 ENERGY DETERMINATION OF GAMMA-RAY SHOWER WITH X-RAY FILM. Kawasumi, N. (Yamanashi Univ., Kofu, Japan). Yamanashi Daigaku Gakugeigakubu Kenkyu Hokoku; No. 24, 28-30(Feb 1974). (In Japanese).

To study high-energy cosmic rays, emulsion cloud chambers (ECC) are usually employed. But the energy determination of the gamma-ray shower generated in an ECC is laborious work. Recently instead of the ECC, x-ray film is utilized to register cosmic rays, and the energy is determined with a photo-densitometer. This article presents the analysis of the incident energy and incident angle of the gamma-ray shower, based on the data measured with an x-ray film type ECC put on a core detector for air shower. The lead plates of 12 cascade unit (cu) thickness were placed on an ECC to generate a gamma-ray shower. Beneath the lead, four sets of two negative x-ray films were set. At the bottom, a scintillation counter was installed for an image intensifier system. Gamma-ray shower blackened x-ray films, and the blackening degree of the films were measured with a micro-densitometer, and the energy was determined. The shower energy was estimated within an error of 0.2 TeV only by the maximum energy of a shower curve drawn by the blackening degree of x-ray films. The zenith angle distribution of incident cosmic ray was mostly around 20°. (JA)

6957 SEARCH FOR A COSMIC RAY SIDEREAL ANISOTROPY IN THE TeV REGION. Bergamasco, L.; Giraud, C. (CNR, Turin). Atti Accad. Sci. Torino. I. Cl. Sci. Fis., Mat. Natur.; 108: No. 1, 109-112(1974).

Data are presented on the arrival times of muons corresponding to primary energies $E_p > 10^4$ GeV. The measurements have been carried out for three years in the Mont Blanc Station at a depth of 4270 m.w.e. The results seem to be against the genuinity of the sidereal effect, even at high energies. (auth)

6958 METHODS FOR THE IDENTIFICATION OF RELATIVISTIC NUCLEI OF COSMIC RADIATION AND FRAGMENTATION PARAMETERS. Domichev, N. V.; Levkovskii, A. A.; Ostroumov, V. I. Tr. Leningrad. Politekh. Inst.; No. 331, 126-231(1973). (In Russian).

The efficiency and quantitative relations for identification methods are reported. Forty-four cases of fragmentation of relativistic nuclei of primary cosmic radiation on the hydrogen of emulsion were developed. The fragmentation parameters of an average number of fragments P of type j, appearing during the fragmentation of primary nuclei of type i, were calculated. (tr-auth)

Stars

Refer also to abstracts 7039, 7046, 7054, 7056, 7251, and 7464.

6959 INFRARED OBSERVATIONS OF BD-10°4662. Hackwell, J. A.; Bopp, B. W.; Gehrz, R. D. (Univ. of Wyoming, Laramie). Astrophys. J., Lett.; 192: No. 2, L79-L81(1 Sep 1974).

Measurements of the unusual object BD-10°4662 at 2.3, 3.6, 4.9, 8.7, and 11.4 μ confirm the small infrared excess discovered by Zappala at $\lambda \leq 3.5\ \mu$. However, measurements at $\lambda \geq 3.5\ \mu$ imply that only 0.02 of the total luminosity of BD-10°4662 is contained in the infrared excess whereas between ~0.15 and 0.9 of the total luminosity of bona fide T Tauri stars appears as excess infrared radiation. These data support Herbig's interpretation of BD-10°4662 as a "post T Tauri star." (auth)

6960 INFRARED PHOTOMETRY OF SS CYGNI AND RX ANDROMEDAE NEAR MAXIMUM. Szkody, P. (Univ. of Washington, Seattle). Astrophys. J., Lett.; 192: No. 2, L75-L77 (1 Sep 1974).

Infrared measurements of two dwarf novae reveal that the observed energy distribution F_λ changes from an approximately $1/\lambda^2$ dependence toward a $1/\lambda^4$ dependence for larger λ at about 1.25 μ. This change of the λ dependence leads to a $n_e \sim 7 \times 10^{13}$ cm^{-3}. The observations of SS Cyg at maximum light from the soft x-ray to the infrared may be fitted by a thermal bremsstrahlung component of 4×10^5 °K, which contributes about 80 percent of the light in the visible region, plus a blackbody component of 30,000 °K. The bremsstrahlung component is attributed to a disk around a white dwarf. (auth)

6961 NEUTRON STARS AND BLACK HOLES. Seldowitsch, Y. Bild Wiss.; 11: No. 3, 54-61(Mar 1974). (In German).

8 figs.

Taking two examples, Hercules X-1 and Swan X-1, the Soviet astrophysicist and cosmologist shows what processes take place between the two components of a double star, one of which is a normal star and the other a neutron star or black hole. The gravitation of the extremely dense satellite causes material to be constantly sucked away from the normal star, and this material rotates in the magnetic field and impacts the surface, in some cases with great energy. (auth)

6962 VIBRATIONAL STABILITY OF STARS IN THERMAL IMBALANCE: A SOLUTION IN TERMS OF ASYMPTOTIC EXPANSIONS. Demaret, J. (Univ., Liege). Bull. Cl. Sci., Acad. Roy. Belg.; 60: No. 2, 183-190(Feb 1974).

The solution of general equations describing the oscillations of stars having a thermal imbalance was constructed in terms of an asymptotic development up to the first order in the Π/t_n parameter, where Π is the adiabatic oscillation period of the fundamental mode and t_n is a slow-time scale of the order of the Kelvin–Helmholtz time. The solution obtained makes it possible to define without ambiguity a vibrational stability coefficient for an arbitrary stellar model and to derive a general formula given the stability analysis results in terms of δr and of $\delta r/r$. The application to the simple case of homogonous contraction led to the recovery, in a much more direct manner, of the results obtained by Cox, Hansen, and Davy. (tr-auth)

6963 EQUIVALENT WIDTHS OF MOLECULAR LINES IN η AQUILAE. Pande, M. C.; Joshi, G. C.; Bondal, K. R. (Uttar Pradesh State Observatory, Naini Tal, India). Bull. Astron. Inst. Czech.; 25: No. 5, 318-319(1974).

Using Dawe's model atmospheres the equivalent widths of R_1 line belonging to the 0–0 band of the electronic transition $B^2\Sigma^+ - X^2\Sigma^+$ of the CN molecule were calculated for various phases of light variation in ηAql. The equivalent width variation shows a good correspondence with the model effective temperatures. A comparison with earlier results shows that the sensitivity of the strength of molecular lines to the variations with phase of the run of temperature with depth in ηAql atmosphere decreases in the order CO, CN, C_2, and CH. (auth)

6964 INITIAL MONOTONOUSLY DECREASING DISTRIBUTION FUNCTIONS OF COSMIC OBJECTS WITH RESPECT TO THEIR IMPORTANCE. Kopecky, M. (Astronomical Observatory, Ondrejov, Czech.). Bull. Astron. Inst. Czech.; 25: No. 5, 271-275(1974).

Relations between the distribution function of cosmic objects with respect to their importance at the time of observation and the distribution function of cosmic objects with respect to their importance at the time of origin of these phenomena are discussed in this paper. (auth)

6965 ORBITAL ELEMENTS OF β PERSEI FROM LIGHT CURVES IN SIX COLORS. Grygar, J. (Astronomical Observatory, Ondrejov); Horak, T. B. Bull. Astron. Inst. Czech.; 25: No. 5, 275-280(1974).

Six light curves of β Persei in the spectral range 3700 to 16,000 A were used for determining the improved elements, using Horák's (1966) first method. The best geometrical elements were obtained under a simple sphere–sphere assumption and using fixed (theoretical) values of the limb darkening. The elements are as follows: $i = 81.4° \pm 0.1°$, $r_1 = 0.214 \pm 0.003$, $r_2 = 0.244 \pm 0.002$. The sphere–ellipsoid elements were also determined. The complexity of the Algol system cannot be overcome by purely mathematical best-fit procedures. For better physical understanding of the semi-detached system it is necessary to get narrow-band light curves in a wide spectral range. (auth)

6966 DETERMINATION OF STELLAR ATMOSPHERE PARAMETERS BY INVERSION OF THE PROFILE OF A SINGLE SPECTRAL LINE. Bielicz, E. (Astrophysical, Spectrophotometry, and Physical Inst., Danzig). Postepy Astron.; 22: No. 3, 191-198(1974). (In Polish).

A method of determining the parameters of the atmosphere of the Sun and other stars from the observed line profile is presented. Taking the source function as given one gets a number of parameters that allow to determine the pressure, temperature, and equilibrium conditions in different atmospheric layers. The method was applied to the D_2 solar line. (auth)

6967 SYNTHESIS OF LIGHT CURVES OF SEMI-DETACHED BINARY STARS. Pustylnik, I. (Inst. of Physics and Astronomy, Tartu). Postepy Astron.; 22: No. 3, 171-189(1974). (In Polish).

The peculiarities of a method of synthesizing light curves of close binaries with the aid of the model atmosphere approach are discussed and some results of its application to several semi-detached systems are given. (auth)

6968 HIGH-DISPERSION SPECTROSCOPY OF THE SIGMA ORIONIS SYSTEM. Bolton, C. T. (David Dunlap Observatory, Toronto). Astrophys. J., Lett.; 192: No. 1, L7-L9(15 Aug 1974).

High-dispersion blue-violet spectra have been taken of σ Orionis E to look for spectrum and velocity variations associated with those found by Walborn in the red spectral region. The 3 σ upper limit on the velocity semi-amplitude is $K \leq 4$ km s^{-1}. This places severe, but not impossible, limits on the mass of any companion. No blue spectrum variations comparable to those in the red have been found, but the Ca II K-line is found to have one or more weak, variable "circumstellar" components. Sigma Orionis AB is found to be a doubled-lined spectroscopic binary. (auth)

6969 DISPERSAL OF THE SHELL OF ZETA OPHIUCHI. Barker, P. K.; Brown, T. (Univ. of Colorado, Boulder). Astrophys. J., Lett.; 192: No. 1, L11-L13(15 Aug 1974).

Observations are presented showing that the shell recently ejected by ζ Oph has now disappeared. Spectral changes, including the disappearance of Hα emission, are described. (auth)

6970 THEORETICAL EXPERIMENT USING GRAVITATIONAL OPTICS TO FIND THE DENSITY FUNCTION OF A STAR. Cyranski, J. F.; Lubkin, E. (Univ. of Wisconsin, Milwaukee). Ann. Phys. (N. Y.); 87: No. 1, 205-243(Sep 1974).

The gravitational deflection of null geodesics passing through a static, spherically symmetric star, as a function of impact parameter, is related to the energy density, as a function of radius. This deflection function is exhibited graphically for two solar models and for Chandrasekhar white dwarfs, assuming small angles, linear superposition of deflections, and negligible pressure. The caustic and axicon infinities in the intensity of short-wave penetrating radiation—neutrinos or very short gravity waves—are described. It is argued that experimental knowledge of the axicon intensity function and of the real caustic locus uniquely define the stellar density function, in the usual case of one virtual caustic branch. The two solar models give rather different distances from the sun to the paraxial focus: 21 and 30 au, unfortunately the nearest infinity. Transverse misalignment of only 7 m, for the case of 21 au, reduces the infinite gain at the paraxial focus to 10^9. (auth)

6971 ROTATING MAGNETIC NEUTRON STARS IN GENERAL RELATIVITY. Cohen, J. M.; Toton, E. T. (Univ. of Pennsylvania, Philadelphia). Ann. Phys. (N. Y.); 87: No. 1, 244-260(Sep 1974).

The effect of slow rotation on the dipole magnetic field of neutron stars is studied. It is shown that the differential rotation of inertial frames produced by the effect of "dragging of inertial frames" induces an additional component of electric field outside the star. This new component, as well as the usual electromagnetic components, vanishes as in the limit of collapse of a star to its Schwarzschild radius. For typical neutron stars, the electric quadrupole moment is about half that obtainable from a flat space analysis. (auth)

6972 SCATTERING OF LIGHT IN A SPHERE WITH AN ARBITRARY DISTRIBUTION OF SOURCES. Engibaryan, N. B. (Inst. of Mathematics, Erevan). Astrophysics (Engl. Transl.); 8: No. 1, 85-87(1972).

Translated from Astrofizika; 8: No. 1, 149-153(1972).

In the study of radiative transfer in a medium whose optical properties possess spherical symmetry, it is usually assumed that the sources are also distributed in a spherically symmetric manner. Such problems have many astrophysical applications. However of no less importance is the problem of transport in a spherically symmetric medium with an arbitrary distribution of interior and exterior sources. The simplest problem of this kind is considered— coherent and isotropic scattering in a homogeneous sphere. (WDM)

6973 INCOHERENT SCATTERING. II. Nonisotropic Scattering. Engibaryan, N. B.; Nikogosyan, A. G. (Inst. of Mathematics, Erevan). Astrophysics (Engl. Transl.); 8: No. 1, 39-51 (1972).

Translated from Astrofizika; 8: No. 1, 71-90(1972).

A study is made of the linear problem of incoherent scattering in a plane-parallel layer of finite thickness, allowance being made for the dependence of the redistribution function on the scattering angle and the nonsphericity of the phase function (scattering indicatrix). The frequency redistribution function at given scattering angle is approximated by a sum of a special form. Systems of integral equations are obtained that in one special case reduce to the solution of functional equations. Some concrete calculations are made in the case of Doppler line broadening. (auth)

6974 EFFECT OF SHOCK WAVES ON Hγ PROFILES AND LIGHT CURVES FOR STARS OF RR LYRAE AND W VIRGINIS TYPE. Golin'ko, V. I. (Gorky Polytechnic Inst., USSR). Astrophysics (Engl. Transl.); 8: No. 1, 52-60(1972).

Translated from Astrofizika; 8: No. 1, 91-105(1972).

A formula is deduced for calculating the emission due to a shock-wave front at the frequencies of spectral lines and in the continuous spectrum. The Hγ profiles are calculated with allowance for the

emission due to a shock-wave front and with and without allowance for absorption in higher-lying layers. It is shown that a shock wave is responsible for an ultraviolet excess. Humps in the light curves are due to heating of a star's atmosphere by the compression wave that follows a shock wave. It is concluded that in the atmospheres of population II type Cepheids there are shock waves with a strength of several units. (auth)

6975 MASS ACCRETION BY A NEUTRON STAR IN A DOUBLE SYSTEM. II. Amnuel, P. R.; Guseinov, O. Kh. (Astrophysical Observatory, Baku). Astrophysics (Eng. Transl.); 8: No. 1, 61-66(1972).

Translated from Astrofizika; 8: No. 1, 107-115(1972).

A study is made of the capture of a plasma flow by the dipole magnetic field of a neutron star (or white dwarf) in a double system. Calculations are made of the fluxes that flow from the principal component at different angles to the line of centers, and a study is made of cases of different inclination of the magnetic axis of the second component. The capture front is at a distance ~10^8 cm from the center of the second component. Radio emission may be produced at the capture front. If the second component is an ordinary star, a synchrotron component may appear in the "hot spot" spectrum. (auth)

6976 DISINTEGRATION THRESHOLD FOR NUCLEI IN A DEGENERATE ELECTRON–NEUTRON GAS. Vartanyan, Yu. L. (Erevan State Univ.). Astrophysics (Engl. Transl.); 8: No. 1, 67-69(1972).

Translated from Astrofizika; 8: No. 1, 117-121(1972).

A study was made of the equation of state of superdense degenerate matter at densities an order of magnitude below the nuclear density. It is shown that the nuclear interaction between outer nucleons plays a role in the determination of the disintegration threshold for nuclei in a degenerate gas of electrons and neutrons. (auth)

6977 NUCLEAR REACTIONS IN A DEGENERATE ELECTRON–NUCLEAR PLASMA. Saakyan, G. S.; Avakyan, R. M. (Erevan State Univ.). Astrophysics (Engl. Transl.); 8: No. 1, 70-79(1972).

Translated from Astrofizika; 8: No. 1, 123-138(1972).

It is well known that in a degenerate electron-nuclear plasma one can have two types of state of thermodynamic equilibrium. One of them corresponds to an absolute minimum of the energy [in this case, the mass numbers A depend on the density: $A = A_0(\rho)$]. The second corresponds to a relative minimum of the energy for any mass spectrum of the atomic nuclei. In the second case, the relaxation times for establishing equilibrium are very short, since the equilibrium is brought about by β processes. In the present paper it is shown that a state of absolute thermodynamic equilibrium can be brought about by nuclei exchanging neutrons. The probability of such exchange is calculated for the liquid and solid phases under the assumption that the matter is in the late stages of evolution, when the mass numbers of the nuclei differ little from $A_0(\rho)$. (auth)

6978 THEORY OF RADIATIVE HEAT EXCHANGE IN ATMOSPHERES. Grinin, V. P. (Crimean Astrophysical Observatory, Simferopol, USSR). Astrophysics (Engl. Transl.); 8: No. 1, 28-38(1972).

Translated from Astrofizika; 8: No. 1, 53-70(1972).

The linearized heat conduction equation is used to investigate the temperature regime in polytropic atmospheres perturbed by concentrated heat sources. Allowance is made for not only the optical inhomogeneity of the atmosphere but also the perturbation of its optical properties. Expressions are obtained for the temperature perturbation produced by a steady point source of heat. For the case of nonsteady perturbations relations are given for the velocity of propagation of heat waves. It is shown that a heat wave propagates into the interior of the atmosphere at a velocity V_z inversely proportional to the pressure scale: $V_z \sim P_g^{-1}(z)$. A wave front propagates in accordance with the same law in the radial direction. The mean time taken by energy to escape from a layer that is at a certain distance z_* from the boundary of the atmosphere is determined. The main characteristics of temperature perturbations are derived for the Sun's atmosphere. (auth)

6979 PHOTOMETRIC AND POLARIMETRIC STUDY OF INFRARED STARS IN THE VISIBLE AND INFRARED SPECTRAL REGIONS. Dombrovskii, V. A.; Khozov, G. V. (Leningrad State Univ.). Astrophysics (Engl. Transl.); 8: No. 1, 1-7(1972).

Translated from Astrofizika; 8: No. 1, 5-16(1972).

The paper presents the results of photometric and polarimetric observations in the visible and infrared spectral regions of four infrared stars. It was found that NML Cyg is a variable star and the polarization of its radiation is formed by interstellar polarization being superimposed on the intrinsic polarization. For IR Tau = NML Tau, the polarization increases continuously with decreasing wavelength in a wide spectral range and varies strongly in time. For IRC + 10216 the polarization in the K band was measured for the first time; it is much less than in the I band, but the position angle is the same. The brightness of VY CMa has continuously decreased during the last two years in the visible region but increased in the infrared. The degree of polarization and the position angle were found to be almost linear functions of the reciprocal wavelength in a wide range from 0.36 to 2.2μ. In the last two years, the amount of polarization has increased continuously in the visible region and decreased in the red and infrared regions, the position angle increasing at all wavelengths. The observations are interpreted by assuming the existence of dust envelopes around cold stars. (auth)

6980 SPECTROPHOTOMETRIC INVESTIGATION OF THE COMETARY NEBULA NGC 2261. Kazaryan, M. A.; Khachikyan, E. E. (Astrophysical Observatory, Moscow). Astrophysics (Engl. Transl.); 8: No. 1, 8-16(1972).

Translated from Astrofizika; 8: No. 1, 17-31(1972).

The results are given of detailed spectrophotometry of the cometary nebula NGC 2261 and its nucleus R Mon. The spectra used were obtained with the 200", 84", 120", and 36" telescopes of the Hale, Kitt Peak, and Lick observatories with dispersions varying from 85 to 420 Å/mm. About 100 emission and absorption lines were observed in the spectra of these objects and identified with the lines of H I, Fe I, Fe II, Ti II, Cr II, Ca II, and Sc II. Their equivalent widths were determined. The spectrum of the nebula contains the forbidden line λ 3727 [O II], which appears at a distance of approximately 40" to the north of R Mon and steadily increases to the periphery of the nebula. The emission lines H_α, H_β, and λ 3727 are also observed to the south of R Mon, the line λ 3727 being already observed in this region in the immediate proximity of R Mon. It is concluded that there is a source of L_c photons in the nebula. The continuous spectrum of the nebula is basically a reflection spectrum. (auth)

6981 GIPOTEZY O ZVEZDAKH I VSELENNOI. (Hypotheses About Stars and the Universe). Bronshten, V. A. Moscow; Izdatel'stvo Nauka Glavnaya Redaktsiya Fiziko-Matematicheskoi Literatury (1974). 384p.

The first section on the Sun and stars discusses solar radiation, the meteor hypothesis, contraction hypothesis, solar spectra, succession, star models, evolution, discoveries in stellar astronomy, and neutron stars. The second section deals with pulsating stars, supernovae, and cosmic rays. The third section discusses hypotheses on the birth of stars. The fourth section deals with galactic evolution. Other sections discuss the redshift, photon aging, anomalous galaxies, and quasars. (JSR)

6982 PROTOSTARS IN CENTRES OF GALAXIES. Mirsojan, L. Veda Tech. SSSR; 1: No. 5, 23-30(Oct 1973). (In Czech).

Two contradictory hypotheses on the nature of the matter of a protostar are presented, namely the classical contraction hypothesis according to which celestial bodies originate by the condensation of diffusion matter (gas or dust) and the protostar hypothesis, according to which stars are the decay products of protostars. The results of observations favoring the protostar hypothesis against the classical contraction hypothesis are presented. (Z.S.)

6983 THERMAL EQUILIBRIUM IN MOLECULAR HYDROGEN CLOUD. Kudo, Akira (Tohoku Univ., Sendai (Japan). Faculty of Science). Sci. Rep. Tohoku Univ., First Ser.; 56: No. 4, 152-169 (Dec 1973).

The thermal balance in molecular hydrogen clouds is considered. Ionization rate by low energy cosmic rays and x-rays is calculated, taking the ionization, dissociation and excitation due to the secondary energetic electrons into consideration. Heating rates by these processes are calculated, including the energy due to the molecular reactions and the effect of energetic electrons. The cooling rates of atomic and molecular species which are efficient in dense clouds are estimated, considering the self-absorption of the cooling lines and the attenuation of ionizing ultraviolet radiation of carbon atoms. The equilibrium temperature at the center of cloud and the hydrogen abundance as functions of hydrogen density are computed for several ionization rates. The comparison with observations shows that if low energy cosmic rays are present in dark clouds, the rate of direct ionization of hydrogen atoms by them should be less than 10^{-18} sec^{-1} which is two orders of magnitude less than required in general interstellar space, and that the energy input to dark clouds due to photoionization by diffuse x-rays above 0.2 keV is comparable in importance to cosmic ray heating. (auth)

6984 EXTENDED ANALYSIS OF Fe V SPECTRA AND ADDITIONAL IDENTIFICATIONS OF Fe VI. Fawcett, B. C. (Culham Lab., Abingdon, Eng.); Henrichs, H. F. Astron. Astrophys., Suppl. Ser.; 18: No. 1, 157-167(Oct 1974).

Emission lines of Fe V belonging to the $d^4-d^3$4p and $d^3$4s$-d^3$4p were classified after a detailed analysis and precise measurements of spectrograms acquired with 6.65 and 10.7 m vacuum spectrographs. Forty-one new levels were found. The wavelengths allow more accurate determination of the d^4 Fe V energy levels and hence provide extra confirmation of the identity of forbidden lines observed in planetary nebulae and the other astrophysical sources. (auth)

6985 LINE BLANKETING AND MODEL STELLAR ATMOSPHERES. III. Tables of Models and Broad-Band Colors. Peytremann, E. (Univ., Bergen). Astron. Astrophys., Suppl. Ser.; 18: No. 1, 81-133(Oct 1974).

Tables show the results of the model atmosphere computations described elsewhere (Peytremann 1974a, paper I). The grid covers the ranges $5000 \leq T_{eff} \leq 8500°K$, $2 \leq \log g \leq 4.5$, $\chi = 0.01$ and 1, where χ is the factor by which the solar abundances other than those of H and He, are scaled. The broad-band colors and bolometric corrections are also presented that were computed by using these models (Peytremann 1974b, paper II). The broad-band system is the one of the Geneva Observatory. (auth)

6986 GLOUBLAR CLUSTER IC. 4499. Fourcade, C. R.; Laborde, J. R.; Arias, J. C. (Observatorio Astronomico, Cordoba, Argentina). Astron. Astrophys., Suppl. Ser.; 18: No. 1, 3-7(Oct 1974).

Adopting for the absolute magnitude of the RR Lyrae the value $M_V = 0.5$ and for the apparent magnitude $m_v = 17.76$ corresponding to the horizontal branch of this cluster, an apparent modulus of 17.26 was found for the visual. Since the adopted absorption is $A_v = 1.05$, a real modulus of 16.21 is obtained which corresponds to a distance of 17 kpc and a height above the galactic plane of 6100 pc characteristic for a globular cluster of low metallicity. (auth)

6987 PHOTOMETRY ON THE BRIGHT STARS OF THE GLOBULAR CLUSTERS NGC 5286 AND NGC 6101. Alcaino, G. (Universidad Catolica de Chile, Santiago). Astron. Astrophys., Suppl. Ser.; 18: No. 1, 9-17(Oct 1974).

A UBV photometric investigation on the bright stars of the Southern Globular Clusters NGC 5286 and NGC 6101 is presented. In NGC 5286, 107 stars were calibrated photographically from a photoelectric sequence of 12 stars. In NGC 6101, 64 stars were calibrated photographically also from a sequence of 12 stars. In both cases, with the available fainter end of the photoelectric sequence at $V \approx 16.1$ the horizontal branch was not detected, and hence on scientific results are discussed. (auth)

6988 NGC 2453, A MODERATELY YOUNG OPEN CLUSTER IN PUPPIS. Moffat, A. F. J.; Fitzgerald, M. P. (Ruhr-Universitaet, Bochum, Ger.). Astron. Astrophys., Suppl. Ser.; 18: No. 1, 19-25(Oct 1974).

For NGC 2453 distance 2.9 ± 0.3 kpc, color excess $E_{B-V} = 0.47 \pm 0.04$ (s.d.), and earliest spectral type b3 were derived. It contains one red (k3) and one blue (B5) bright giant and an emission-line b4 IV star. (auth)

Quasi-Stellar, Radio, and X-Ray Sources

6989 (AD-780923) APERTURE SYNTHESIS OF FORMALDEHYDE ABSORPTION IN SGR B2. Rogstad, D. H.; Lockhart, I. A.; Whiteoak, J. B. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094-0019. 21p. NTIS $3.00.

Synthesis observations of the 4830 MHz formaldehyde absorption originating near Sgr B2 have been obtained with a resolution of 20 arcsec in right ascension and 40 arcsec in declination. The velocity resolution was 3.1 km/s. The results suggest that there are at least two absorbing clouds near the source. One cloud has a velocity of 80 km/s and is associated with only one of the two bright continuum components. Another cloud, with a velocity of 65 km/s, overlies the entire continuum distribution. At a velocity of 50 km/s, there is some evidence that a third cloud covers the southernmost region of the source. (auth)

6990 (UCRL-75895) APPLICATION OF DIGITAL IMAGE RESTORATION IN X-RAY ASTRONOMY. Ekstrom, M. P.; Woods, J. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Jul 1974. 8p. (CONF-741031-1). Dep. NTIS $4.00.

From EASCON conference; Washington, District of Columbia, USA (7 Oct 1974).

The use of coded aperture imaging techniques in x-ray astronomy is considered. A systems model for the imaging of x rays using multiple pinhole masks is presented and the problem of decoding the formed image in the context of image restoration is formulated. Optimal algorithms are then derived for performing this restoration and their performance evaluated. (auth)

6991 X-RAY ABSORPTION EVENTS IN CYGNUS X-1 OBSERVED WITH COPERNICUS. Mason, K. O. (University Coll., London); Hawkins, F. J.; Sanford, P. W.; Murdin, P.; Savage, A. Astrophys. J., Lett.; 192: No. 2, L65-L69(1 Sep 1974).

Four x-ray absorption events in Cyg X-1 were observed with the Copernicus satellite. The events have been related to the orbital phase of HDE 226868, confirming the identification. Evidence was found that they are caused by the gas stream and that the gas stream is not fixed in relation to the spectroscopic binary system. (auth)

6992 SEARCH FOR ADDITIONAL RADIO SOURCES IN THE KUKARKIN VARIABLE STAR CATALOG. Shaffer, D. B. (Yale Univ. Observatory, New Haven); Shields, G. A. Astrophys. J., Lett.; 192: No. 2, L83-L84(1 Sep 1974).

A search of the Kukarkin variable-star catalog for objects similar to BL Lac or BW Tau, originally thought to be variable stars but subsequently identified as radio galaxies, gave negative results. (auth)

6993 22 GHz OBSERVATIONS OF SOUTHERN H_2O SOURCES. Caswell, J. L.; Batchelor, R. A.; Haynes, R. F.; Huchtmeier, W. K. (Max-Planck Institut fuer Radioastronomie, Bonn). Aust. J. Phys.; 27: No. 3, 417-424(Jun 1974).

The discovery of three new H_2O sources associated with HII regions is reported. Observations of other southern H_2O sources show, in several instances, considerable intensity changes over a 20-month interval. (auth)

6994 MICROWAVE EMISSION OF THE $2_{11} \rightarrow 2_{12}$ ROTATIONAL TRANSITION INTERSTELLAR ACETALDEHYDE. Fourikis, N. (CSIRO, Epping, Australia); Sinclair, M. W.; Robinson, B. J.; Godfrey, P. D.; Brown, R. D. Aust. J. Phys.; 27: No. 3, 425-430(Jun 1974).

The $2_{11} \rightarrow 2_{12}$ transition of acetaldehyde at 3195·167 MHz has been observed in emission in Sgr B2 with the Parkes 64 m telescope. Comparison of the intensities of the $1_{10} \rightarrow 1_{11}$ and $2_{11} \rightarrow 2_{12}$ emission lines suggests that both transitions may be inverted. (auth)

6995 DISTANCES TO QUASARS. Zonn, W. (Warsaw Astronomical Observatory). Postepy Astron.; 22: No. 3, 217-228(1974). (In Polish).

A short review is given of discussion concerning quasar distances. (auth)

6996 B2 CATALOGUE OF RADIO SOURCES: FOURTH PART. Fanti, C.; Fanti, R.; Ficarra, A.; Padrielli, L. (CNR, Bologna). Astron. Astrophys., Suppl. Ser.; 18: No. 1, 147-156 (Oct 1974).

A list is given of 448 radio sources observed with the Bologna Northern Cross Telescope, in an area of 0.204 steradians, between $\delta = 21°40'$ and $\delta = 24°02'$. The list includes sources stronger than 0.5 f.u. and is complete to 0.6 f.u. at 408 MHz. (auth)

Solar Phenomena

Refer also to abstracts 5747, 6952, and 6955.

6997 (COM-74-50190/9) SOLAR-GEOPHYSICAL REPORTS. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). 1974. vp. National Climatic Center, Ashville, N. C. 28801 $1.25.

6998 (COM-74-50190-353-1) SOLAR-GEOPHYSICAL DATA NUMBER 353, JANUARY 1974. Part I (Prompt Reports). Data for December 1973, November 1973. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Jan 1974. 118p. (SGD-353-PT-1). National Climatic Center, Ashville, N. C. 28801 $1.25.

Prompt reports are given on data for December 1973 and November 1973. These deal with alert periods, daily solar indices, solar flares, solar radio waves, and spacecraft observations. (GRA)

6999 (COM-74-50190-353-2) SOLAR-GEOPHYSICAL DATA NUMBER 353, JANUARY 1974. Part II (Comprehensive Reports).

Data for July 1973, June 1973,and Miscellanea. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo (USA)). Jan 1974. 90p. (SGD-353-PT-2). National Climatic Center, Asheville, N. C. 28801 $1.25.

The issue provides comprehensive data for July 1973 and June 1973 on solar flares, solar radio waves, solar x-ray radiation, and solar proton monitoring. It also has miscellaneous data for December 1972 – May 1973. (GRA)

7000 (COM-74-50190-354-1) SOLAR-GEOPHYSICAL DATA NUMBER 354, FEBRUARY 1974. Part I (Prompt Reports). Data for January 1974, December 1973. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Feb 1974. 116p. (SGD-354-PT-1). National Climatic Center, Asheville, N. C. 28801 $1.25.

Prompt reports are given on data for January 1974 and December 1973. These deal with alert periods, daily solar indices, solar flares, solar radio waves and spacecraft observations. (GRA)

7001 (COM-74-50190-354-2) SOLAR-GEOPHYSICAL DATA NUMBER 354, FEBRUARY 1974. Part II (Comprehensive Reports). Data for August 1973, July 1973, and Miscellanea. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Feb 1974. 49p. (SGD-354-PT-2; NOAA-74031504;354). National Climatic Center, Asheville, N. C. 28801 $1.25.

The issue provides comprehensive data for August 1973 and July 1973 on solar flares, solar radio waves, solar x-ray radiation and solar proton monitoring. (GRA)

7002 (COM-74-50190-354-S) SOLAR-GEOPHYSICAL DATA. Descriptive Text. Number 354 (Supplement), February 1974. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo (USA)). Feb 1974. 84p. (SGD-354-SUPP; NOAA-74031505;354). National Climatic Center, Asheville, N. C. 28801 $1.25.

The pamphlet contains the description and explanation of the data contained in the monthly publications solar-geophysical data, issued by the environmental data service of the national oceanic and atmospheric administration. Beginning with the July 1969 issue the publication was divided into two parts (I and II). Part I contains data for the month one month before and month of publication and for the second month before. Part II contains data for the sixth month before the month of publication and the seventh month before. Special data for miscellaneous times are given from time to time in Part II. The first page of each issue gives the general contents and is backed by a running index to locate data for a specific month for the past year. A complete index for data since July 1957 is given in a special section. (GRA)

7003 SOLAR TERRESTRIAL RELATIONS. Proceedings of the International Conference Held at Calgary, Alberta, Canada, August 28 – September 1, 1972. Calgary, Alberta; University of Calgary (1973). 747p. $20.80.

Theoretical analyses and experimental data are presented on a wide range of solar events with special reference to the ways in which these events correlate with atmospheric and magnetospheric phenomena on Earth. Some of the topics covered include solar flare theory, cosmic-ray propagation and modulation in the interplanetary medium, plasma instabilities in the magnetosphere, substorm phenomena, sources of auroral ion precipitation, storage and release of nonthermal energy in the Sun's atmosphere, absence of coronal particle storage in solar-flare events, discontinuities in the solar wind, particle acceleration in the interplanetary medium, field-aligned currents in auroral oval, morphology of auroral phenomena, and parallel electric fields in the magnetosphere. Separate abstracts are prepared for 37 papers. (WDM)

For abstracts of individual chapters see: 6952–6955, 7004–7021, 7077–7080, and 7095–7105.

7004 WHAT WE THINK WE KNOW AND DO NOT KNOW ABOUT SOLAR FLARES. Parker, E. N. (Univ. of Chicago). pp 1-22 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Solar-terrestrial relations begin in the convective zone of the Sun. A combination of nonuniform rotation and cyclonic convection generates magnetic fields in migratory waves, which can account for the observed 22-year solar magnetic cycle. The magnetic fields are the active agent in creating the active magnetic regions, with sunspots, prominences, and flares. The present status of knowledge regarding the solar flare phenomenon is reviewed, giving attention to the extraordinary complexity of the solar flare and the broad spectrum of theoretical ideas that have been generated to meet the challenge. (IAA)

7005 OBSERVATIONAL ASPECTS OF FLARES. Svestka, Z. (European Space Research and Tech. Centre, Noordwijk, Netherlands). pp 23-61 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

As soon as a bipolar magnetic configuration is formed in the solar atmosphere, flares begin to appear. The most important flares, and the highest number of them, occur in magnetically complex active regions, where the magnetic configuration deviates from the simple bipolar structure and the magnetic polarities are greatly mixed. Flare location, two-ribbon flares, flare-associated changes in the magnetic field, and thermal flares are discussed. Attention is given to the x-ray spectrum, the nonthermal phase of flares, loop-like structure of flares, flare-associated radio bursts, proton events, electron events, neutrons and gamma-rays, the chromospheric flare, and flare energy. (IAA)

7006 SOLAR FLARE THEORY. Sturrock, P. A. (Stanford Univ., CA). pp 63-71 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

The impulsive nature of most solar flares implies that a flare is a sudden release of energy. Indications are that the flare process occurs entirely within the atmosphere of the Sun. With rare exceptions, nothing is observed to occur at the photosphere during a flare. This implies that the stored energy, which is released during a flare, is contained in the Sun's atmosphere. It was pointed out by Gold and Hoyle (1960) that, since the density of gas in the corona is so low, the only way in which sufficient energy can be stored in the Sun's atmosphere is in the form of magnetic energy. This view is fully consistent with the fact that flares typically occur in active regions which involve strong magnetic fields. (IAA)

7007 RELATION BETWEEN THE POLARITY OF THE INTERPLANETARY MAGNETIC FIELD AND THE POLAR GEOMAGNETIC FIELD. Svalgaard, L. (Stanford Univ., CA). pp 231-241 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

The relation between the azimuthal component of the interplanetary magnetic field and the polar-cap geomagnetic field is discussed. The geomagnetic effects can be described as produced by an ionospheric current system encircling the magnetic pole. The sense of the current is clockwise during toward-sectors and reversed during away-sectors. The importance of this very direct solar–terrestrial relation is stressed. A recent magnetic sunspot cycle model is discussed as inferred from this relationship, the basic feature being that the sun reproduces the same sector pattern during every sunspot cycle. (auth)

7008 DISTRIBUTION OF TEMPERATURE AND EMISSION MEASURE IN SOLAR FLARES. Syrovatskii, S. I. (Lebedev Inst. of Physics, Moscow); Shmeleva, O. P. pp 243-274 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

The distribution of temperature and emission measure in flare due to stationary heating of the chromosphere was found for two limiting cases of slow and fast heating, when either the gas pressure or the concentration are constant along the layer depth. Results are relevant to the conditions when the energy injected by nonthermal particles quickly transforms into a thermal flux. Under these conditions the temperature distribution along depth is determined by radiation loss and thermal conductivity, and at any values of energy flux and plasma concentration it is characterized by two universal functions. One of them establishes the relation between the energy flux and temperature at the region boundary; the other – the temperature run along depth. (auth)

7009 TWO ASPECTS OF SOLAR COSMIC RAY PROPAGATION. Lanzerotti, L. J. (Bell Telephone Labs., Inc., Murray Hill, NJ). pp 283-305 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Two separate problems in low-energy solar particle propagation are discussed. First, the onset times of solar particles are investigated as a function of particle energy and solar flare

longitude. A diffusion coefficient of approximately 3.4×10^{17} cm^2/sec deduced for coronal transport of the initial flare protons of energy 13 and 25 MeV. The situation is more complex with respect to the initial protons of 600 keV energy; storage of these protons may exist for up to one hour before injection onto the spiral field lines. Second, changes in the solar-flare alpha-to-proton ratios are investigated following several flares. The He-4/H-1 ratios from particles compared as to equal energy/charge (particles with the same velocity times rigidity) are not affected by flare-produced interplanetary shock waves. A schematic model for the energy-dependence of the interplanetary propagation is presented. (auth)

7010 ACCELERATION OF ELECTRONS IN SOLAR FLARES. Lin, R. P. (Univ. of California, Berkeley). pp 307-340 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Observations pertaining to the acceleration and emission of 10 to 100 keV electrons in small solar flares are reviewed. The energy spectrum of the accelerated electrons is obtained from observations of x rays and escaping electrons. The loss of the electrons through various processes, such as collisions with the ambient medium, escape to the interplanetary medium, and emission of x rays and radio waves, is considered, and quantitative energy loss estimates obtained for each process. The role of the accelerated electrons in the overall flare mechanism is examined and an attempt is made to develop a consistent picture of a small electron flare. (auth)

7011 CORONAL MAGNETIC FIELDS AND THE STRUCTURE OF LOW-ENERGY SOLAR CHARGED PARTICLE EVENTS. Roelof, E. C. (Univ. of New Hampshire, Durham). pp 341-370 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

The synthesis of coronal and interplanetary data for Carrington Rotation 1523 (July–August, 1967) is presented as an example of a new technique for interpreting low-energy solar charged-particle (LESP) events. Solar-wind velocity is used to infer the equatorial coronal longitude of the injection of the LESP, and comparison of the longitude injection profiles is then made directly with chromospheric magnetic neutral-line structure deduced from H-alpha filtergrams. These equatorial neutral-line boundaries are then seen to order the interplanetary LESP field-aligned populations. The agreement of chromospheric equatorial H-alpha structure with LESP observations serves as a self-consistent justification of the new technique. (auth)

7012 DISCONTINUITIES IN THE SOLAR WIND. Burlaga, L. F. (Goddard Space Flight Center, Greenbelt, MD). pp 371-376 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

The ratio of rotational discontinuities (RD's) to tangential discontinuities (TD's) in the solar wind at 1 AU is considered, along with some of its major implications. In particular, the ratio of the number of RD's to TD's in an interval typical of the solar wind is searched. Some of the involved difficulties are discussed, and several alternate questions are raised. (IAA)

7013 INTERPLANETARY DYNAMICS AND THE CORONAL ORIGIN OF SOLAR WIND VARIABILITY. Gosling, J. T. (High Altitude Observatory, Boulder, CO). pp 377-392 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

A discussion is given on the difficulties encountered in attempts to relate particular solar-wind variations with observed inner corona and/or surface features on the Sun. The fundamental importance of the evolution of solar-wind streams in transit from the Sun to the Earth is stressed: only when the effects of this evolution are removed can one hope to distinguish "true" coronal signals. Some clues to the origin of solar-wind streams in the inner corona are reviewed. (IAA)

7014 SOLAR WIND FLUCTUATIONS IN THE OUTER SOLAR SYSTEM. Siscoe, G. L. (Univ. of California, Los Angeles). pp 395-400 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

A spherically symmetric solar wind with an axially symmetric spiral magnetic field is considered as a model that may contribute to the understanding of solar-wind fluctuations in the outer solar system. It is shown that, in this model of alternating high and low density bands, fluctuations can arise from interactions with the interstellar medium. (IAA)

7015 CAN SCATTERING FROM INTERPLANETARY BLAST DISTURBANCES CONTRIBUTE TO THE SOLAR COSMIC RAY PROPAGATION PROCESS. Barouch, E. (CEA, Gif-sur-Yvette, France). pp 401-408 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

A solar cosmic ray propagation model is considered that suggests that backward scattering of solar particles from interplanetary blast disturbances may contribute to the solar cosmic-ray propagation process. Numerical calculations based on this model yield intensity-time profiles which are not very different from those actually observed. (IAA)

7016 NEW ASPECTS OF INTERPLANETARY PROPAGATION REVEALED BY GREATER THAN 0.3 MeV SOLAR PROTON EVENTS IN 1967. Roelof, E. C. (Univ. of New Hampshire, Durham). pp 411-440 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Using multiple spacecraft measurements of plasma and protons with energy greater than about 0.3 MeV, taken by separated spacecraft during the period July 24–August 7, 1967, it is found that these protons undergo "collective collimation" in which their velocity, transverse to interplanetary magnetic field lines, is just equal to that of the lines themselves (showing no measurable transverse diffusion) while the propagation along the field lines is de-coupled from the local plasma conditions. Moreover, when the proton anisotropy direction (Explorer 35) is compared with the direction of the interplanetary magnetic field (Explorer 34), it is found that throughout the 3-day exponential decay of a solar proton event the anisotropy amplitude is approximately equal to the theoretical Compton–Getting anisotropy for radial convection, but the anisotropy direction is nearly field-aligned. (auth)

7017 PARTICLE ACCELERATION IN THE INTERPLANETARY MEDIUM. I. Summary of In Situ Observations. Armstrong, T. P. (Johns Hopkins Univ., Silver Spring, MD). pp 441-452 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Summary is given of observational evidence for the interplanetary acceleration of charged particles by propagating interplanetary shock waves. The characteristics of reported shock-associated accelerations include: (1) intensity spikes characterized by durations of 10 to 20 minutes; (2) absence of electron effects at the 40 keV energy level; and (3) large effects of alpha particles. (IAA)

7018 PARTICLE ACCELERATION IN THE INTERPLANETARY MEDIUM. II. Numerical Simulation of the Motions of Charged Particles Near Interplanetary Shock Waves. Chen, G. (Univ. of Kansas, Lawrence); Armstrong, T. P. pp 453-460 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

7019 FOKKER–PLANCK EQUATIONS FOR CHARGED-PARTICLE TRANSPORT WITH A DISCUSSION OF SOME HIGHER-ORDER EFFECTS. Jokipii, J. R. pp 463-475 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

A derivation of the Fokker–Planck equation, based on the central limit theorem, is presented which clearly illustrates the conditions for its validity. It is reiterated that previous use of the Fokker–Planck equation in cosmic-ray transport is correct. Higher-order effects associated with magnetic mirroring and field line random walk at low energies are discussed heuristically. (auth)

7020 RECENT SOLAR WIND VELOCITY MEASUREMENTS OUT OF THE ECLIPTIC PLANE. Coles, W. A. (Univ. of California, San Diego, La Jolla). pp 653-659 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

The interplanetary scintillation technique was used in the investigation. The 1972 data from March through July are sum-

marized in a graph. Another graph shows a scatter diagram of magnitude versus latitude for the peak velocity measured in 1972. A plot of peak velocity versus Carrington longitude for the 1972 observations is also presented along with the velocity autocovariance in longitude for 3C144 and 3C48. (IAA)

7021 OBSERVATIONS OF NARROW BAND SOLAR BURST STRUCTURE AT DECAMETER WAVELENGTHS. Mosier, S. R. (Goddard Space Flight Center, Greenbelt, MD). pp 661-675 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

A high-speed digital solar radio spectrograph was used in the investigation. This instrument made it possible to observe solar bursts with a time and frequency resolution not obtainable with conventional sweep-frequency spectrographs. A Type III burst observed at 40 MHz is shown. The rise and the decay of the Type III burst is smooth and gradual, with the decay time exceeding the rise time. An isophote diagram of the same burst is also presented along with some other events. (IAA)

7022 DECAY PRODUCTS OF EXTINCT RADIONUCLIDES AND THEIR COSMOCHEMICAL IMPORTANCE. Kirsten, T. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F. R. Germany)). Chem.-Ztg., Chem. App.; 98: No. 6, 288-293(Jun 1974). (In German).

5 figs.; 33 refs.

Now extinct radionuclides with half-lives between 10^6 and 10^8 years were still present during the formation of the solar system about 4.6 b.y. ago. Their decay products can be detected in meteorites, in lunar rocks, and on earth. They allow the absolute determination of short time intervals around the birth date of the planetary system. In essence, the solar system was formed within only approximately 15 m.y. Nuclei contained in the solar system were still synthesized as late as approximately 100 million years before its formation. (auth)

7023 DEPENDENCE BETWEEN THE BASIC ELEMENTS OF THE 22-YEAR CYCLE OF SOLAR ACTIVITY. Bonov, A. Izv. Sekts. Astron., Bulg. Akad. Nauk.; 5: 33-40(1972). (In Russian).

A reverse correlation between the duration of the even 11-year cycle and R^{M}_{2n+1} the Wolf number in the epoch of the maximum of the odd 11-year cycle has been established. By this it is reaffirmed that the even and the odd 11-year cycle form a whole, the 22-year cycle of solar activity. Such dependence does not exist if the 22-year cycles begin with an odd 11-year cycle. (Abstr. Bulg. Sci. Lit., Math., Phys., Astron., Geophys., Geod. Vol. 10, No. 2, 1972)

7024 SOLAR-TERRESTRIAL DISTURBANCES OF AUGUST 1972. XVII. On the Relation Between the Solar Activity and the Tidal Force on the Sun Induced by the Planets. Takahashi, K. (Radio Research Lab., Tokyo). Denpa Kenkyusho Kiho; 19: No. 103, 379-383(Jul 1973). (In Japanese).

In order to explain the distinguished solar activity in August 1972, the relation between the solar activity and the tidal force on the solar surface induced by the planets was investigated. It is qualitatively shown that the solar activity is closely related to the variation of the tidal force expressed by the co-ordinates fixed to the solar surface, and that the nonthermal decametric emission from Jupiter is modulated by the tidal force induced by Io, the first Galilean satellite of Jupiter. If the solar activity is reduced to the tidal force, it will become clear that the solar active regions occur symmetrically with respect to the solar equator and that the occurrence of the active regions is limited in the medium latitude areas. (auth)

7025 CONTRIBUTION OF THE SOLAR DISCRETE X-RAY SOURCES TO THE D-REGION IONIZATION DURING THE SOLAR ECLIPSE ON 20 MAY 1966. Letfus, V. (Astronomical Observatory, Ondrejov, Czech.); Apostolo, E. M.; Nestorov, G. T. Bull. Astron. Inst. Czech.; 25: No. 5, 262-267(1974).

Measurements of the ionospheric absorption by the A3 method were carried out at the Ionospheric Observatory in Sofia and at the Ionospheric Station in Michurin during the solar eclipse of May 20, 1966. The analysis of the records of the field strength on the paths 1412 kHz/170 km and 2761 kHz/591 km enables one to separate the contribution of the solar discrete x-ray sources, localized in the active regions McMath 8294, 8302, and 8310. On both paths a SID-effect of a weak solar flare localized in the region McMath 8294, was recorded. Quantitative estimates are given for the integral fluxes of the x radiation of the separate regions $\lambda \leq$ Å, and its comparison with those derived by Letfus and Livshits (1972) from direct satellite measurements yields a very good correlation. This signifies that the ionospheric absorption measurements in the D region can be used with success for determining the ionizing x-ray emission of the Sun for wavelengths shorter than 8 Å. (auth)

7026 ENERGY-SPECTRUM DISTRIBUTION OF THE SOLAR X RADIATION OF LESS THAN 8 Å AND ITS RELATION TO THE SOLAR RADIO EMISSION OF 2800 MHz. Apostolov, E. M. (Geophysical Inst., Sofia). Bull. Astron. Inst. Czech.; 25: No. 5, 268-271(1974).

Data of the x-ray flux in the 0.5 to 3 Å and 1 to 8 Å ranges are used for obtaining the energy-spectrum distribution of x radiation of less than 8 Å in the form of the power law $I(\lambda) = k \cdot \lambda^n$. The numerical value of the power n is taken as an indicator of the steepness of the spectrum, or of the radiation hardness. The values of n under quiet and flare conditions are compared with the corresponding values of the solar radio emission on 2800 MHz. It was found that under quiet conditions an obvious dependence between n and $F_{2800\,MHz}$ does not exist, while in the maximum of solar flares there is a strict dependence, expressed by means of the non-linear law $n = n_0 + p\ (\ln F_{2800\,MHz})^m$. (auth)

7027 CORRELATION BETWEEN METEOROLOGICAL MICROSEISMS AND SOLAR ACTIVITY. Zatopek, A. (Charles Univ., Prague); Krivsky, L. Bull. Astron. Inst. Czech.; 25: No. 5, 257-262(1974).

Correlation between the so-called meteorological microseisms, i.e., quasi-harmonic oscillations of the Earth's surface (period range from 3 to 10 seconds) due to the atmospheric-pressure variation effects at the ocean bottom, and the atmospheric circulation is well known. In the present paper the authors demonstrate that this correlation also exists for the long-term microseismic activity and solar phenomena. Microseismic activity, if followed in adjusted amplitude values of microseisms throughout time intervals of the order of one or more periods of solar activity, is closer to (negative) variations of the intensity of cosmic rays and frequency of occurrence of solar flares, associated with Type IV radio emissions, than to curves of Wolf's numbers R. It is concluded that the streams of active solar particles and fields affect not only the high atmospheric layers in the polar caps of the Earth, but also the whole of circumpolar phenomena responsible for the activity of the "great polar vortex" in the lower atmosphere. (auth)

7028 SOLAR NEUTRINOS. Ulrich, R. K. (Univ. of California, Los Angeles). AIP (Amer. Inst. Phys.). Conf. Proc.; No. 22, 259-272(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

The current status of the experimental efforts by Davis to detect neutrinos from the sun is reviewed from the point of view of the theory of solar models. The essential physical input for a standard model of the sun is presented. Ten different hypothetical explanations of the discrepancy between the theoretically expected ^{37}Ar production rate and the observed production rate are discussed. None of these hypotheses are entirely satisfactory. One, the low Z model, is marginally attractive, but it requires the sun to have a very unusual chemical composition. The errors in the fluxes from the standard model and the low Z model resulting from errors in the input data lead to ^{37}Ar production rates of 5.6 ± 1.8 and $1.4 \pm 0.35 \times 10^{-36}$ atoms/target atom/sec, respectively. (auth)

7029 MECHANISM OF SOLAR ACTIVITY. Dauvillier, M. A. (College de France, Paris). Bull. Cl. Sci., Acad. Roy. Belg.; 54: No. 9, 917-925(Oct 1973). (In French).

It is shown that by attributing the solar activity to planetary tides and the conversion of thermal energy into electrical to the filaments of granulation, the differential rotation of the photosphere and the Hale laws on the magnetism of the sunspots can be explained. (tr-auth)

7030 SOLAR-TERRESTRIAL DISTURBANCES OF AUGUST 1972, 15. Simultaneous Measurement of Intensities and Phase of Loran-C Waves. Ouchi, Choshichi; Fujii, Shu; Wakai, Noboru (Radio Research Lab., Nakaminato, Ibaraki (Japan). Hiraiso Branch). Denpa Kenkyusho Kiho; 19: No. 103, 367-372(Jul 1973). (In Japanese).

The intensities and phase of Loran-C (100 kHz) waves observed at Hiraiso exhibited several remarkable responses to unusually high solar activity which occurred early in August 1972. Outstanding SFA's (Sudden Field Anomalies) in the signal from four Loran-C transmitters encircling Hiraiso as well as corresponding SPA's (Sudden Phase Anomalies) in the Master (Iwojima) signal are presented. The preliminary analysis of those records visualizes the transition of electron concentration in the D region in association with the solar x-ray bursts. (auth)

7031 TIME OPTIMIZATION OF THE VARIABLE OF THE THICKNESS OF RADIATION SHIELDING AGAINST SOLAR FLARE PROTONS. Sakovich, V. A. Kosm. Biol. Aviakosmicheskaya Med.; 8: No. 5, 79-81(1974). (In Russian).

The complements to existing calculation programs on the radiation shielding needed during prolonged space flight are derived with a consideration of the variability of the shielding needed as a result of solar flare protons. (JSR)

7032 SLOWLY VARYING COMPONENT OF EXTREME ULTRAVIOLET SOLAR RADIATION AND ITS RELATION TO SOLAR RADIO RADIATION. Chapman, R. D.; Neupert, W. M. (Goddard Space Flight Center, Greenbelt, MD). J. Geophys. Res.; 79: No. 28, 4138-4148(1 Oct 1974).

A study of the correlations between solar euv line fluxes and solar radio fluxes was carried out. A calibration for the Goddard Space Flight Center euv spectrum is suggested. The results are used to obtain an equation for the absolute euv flux for several lines in the 150- to 400-Å region and the total flux of 81 intense lines in the region, the 2800-MHz radio flux being used as independent variable. (auth)

7033 EFFECTS OF INTERPLANETARY SHOCK WAVES ON ENERGETIC CHARGED PARTICLES. Sarris, E. T.; Van Allen, J. A. (Univ. of Iowa, Iowa City). J. Geophys. Res.; 79: No. 28, 4157-4173(1 Oct 1974).

The influence of interplanetary shock waves on energetic charged particles is studied in this work. Emphasis is given to the acceleration of protons in almost perpendicular shock waves (the angle ϕ between the shock normal and the upstream magnetic field being greater than about 80°). The special case of protons accelerated in ideal perpendicular shock waves is treated analytically. The protons gain energy by repeated crossings of the shock front until they are finally permanently transmitted downstream. The resulting energy gain complies with the conservation of the first adiabatic invariant. It is found that the times required by protons to reach a given relative energy gain at the shock front are longer for higher proton energies. In about 3 min a 0.3-MeV proton has almost tripled its energy at a shock front of strength 3, whereas a 10-MeV proton has barely started gaining some energy in the same time interval. The acceleration of protons by reflection at oblique shock waves as well as the required times is also examined: significant energy gains are found for ϕ greater than about 80°, increasing with ϕ. Intensive acceleration of protons thus occurs when the upstream interplanetary magnetic field is almost parallel to the shock front. However, because of the directional magnetic fluctuations that characterize the interplanetary medium the magnetic field vector ahead of the shock stays almost parallel to the front for only a short time (a few minutes, in general). This time is enough for the low-energy protons ($E_p \lesssim 1$ MeV) to be accelerated to about 2 to 3 times their original energy but not enough for the high-energy protons ($E_p > 10$ MeV) to be noticeably affected by the shock wave. This result explains the absence of "spike" events from the high-energy proton observations. The intensity and energy spectrum variations of a given proton population interacting with a perpendicular shock wave are also obtained theoretically as functions of time. It is found that a softer spectrum results after the intense acceleration in perpendicular shock fronts; also, large intensity enhancements created within a few minutes are predicted that can account for the observed impulsive low-energy storm proton events (spikes or LESP's). Simultaneous low-energy proton ($E_p > 0.3$ MeV) and magnetic field observations from July 1967 to December 1970 by the Iowa particle experiments and the Ames magnetometers on board the satellites Explorer 33 and 35 are analyzed, and the experimental results are found to be in excellent agreement with the theoretical predictions. Large spike events are observed only in association with almost perpendicular shock waves. On the other hand, oblique shock waves are associated only with weak spike events, which can be accounted for by sweeping and albedo acceleration. (auth)

7034 TEMPERATURE GRADIENT IN THE SOLAR NEBULA. Lewis, J. S. (California Inst. of Tech., Pasadena). Science; 186: No. 4162, 440-443(1 Nov 1974).

The available compositional data on planets and satellites can be used to place stringent limits on the thermal environment in the solar nebula. The densities of the terrestrial planets, Ceres and Vesta, the Galilean satellites, and Titan; the atmospheric compositions of several of these bodies; and geochemical and geophysical data on the Earth combine to define a strong dependence of formation temperature on heliocentric distance. The pressure and temperature dependences of the condensation process are separable in the sense that the variation of the deduced formation temperatures with heliocentric distance is insensitive to even very diverse assumptions regarding the pressure profile in the nebula. It is impossible to reconcile the available compositional data with any model in which the formation temperatures of these bodies are determined by radiative equilibrium with the Sun, regardless of the Sun's luminosity. Rather, the data support Cameron's hypothesis of a dense, convective solar nebula, opaque to solar radiation, with an adiabatic temperature-pressure profile. (auth)

Galaxies

Refer also to abstract 6982.

7035 (AD-780922) MODELS OF MASSIVE MOLECULAR CLOUDS. Zuckerman, B.; Evans, N. J. II. (Owens Valley Radio Observatory, Pasadena, Calif. (USA)). 1974. Contract N00014-67-A-0094. 14p. (NSF-GP-30400). NTIS $3.00.

Observations of carbon monoxide lines from massive molecular clouds, such as those near Orion A and Sgr B2, have recently been interpreted in terms of large scale motions, generally collapse or expansion, that imply rapid evolution of these clouds. The authors suggest an alternative explanation: the clouds are not dominated by large scale systematic motions and the CO profiles are determined primarily by local motions. Therefore, it is generally not possible to see through these clouds in optically thick lines of molecules such as CO and HCN. Some consequences and tests of this model are briefly discussed. (auth)

7036 KINEMATIKA I DINAMIKA ZVEZDNYKH SISTEM FIZIKA MEZHZVEZDNOI SREDY. (Kinematics and Dynamics of Stellar Systems and Physics of the Interstellar Medium). Alma-Ata; Izdatel'stvo Nauka (1965). 307p.

Twenty-six of the papers presented at the All-Union Conference and the discussions following them are compiled. Abstracts of other papers are included. Many of the papers have English abstracts. (JSR)

7037 THIRD INTEGRAL OF MOTION IN A SYSTEM WITH A POTENTIAL OF THE FOURTH DEGREE. III. A Method of Solving the Resonance Case 2:1. Andrle, P. (Astronomical Inst., Prague). Bull. Astron. Inst. Czech.; 25: No. 5, 280-286 (1974).

Assuming that a steady-state galaxy possesses a plane and an axis of symmetry and that its potential is a polynomial of the fourth degree the first approximation to a formal third integral of motion was found in terms of Weierstrassian elliptic functions (Andrle, 1966). Explicit expressions of the second approximation were derived for the simplest resonance case 1:2 (Andrle, 1973). The case leading to the resonance 2:1 in real and 1:1 in imaginary periods is treated in greater detail. The second approximation of the third integral is found in the form of a simple function of $P(\frac{1}{2}\tau)$ and the half-argument Weierstrassian function is expressed as a function of the coordinates and velocities with the error (almost always) of less than 1%. The accuracy of the results can be arbitrarily improved. (auth)

7038 DIFFUSION. Arkuszewski, W. (Inst. of Astronomy, Warsaw). Postepy Astron.; 22: No. 3, 199-216(1974). (In Polish).

Problems related to diffusion are described. An elementary theory of molecular diffusion is presented. The analogy between the turbulent and molecular diffusion allows one to estimate the influence of the former on astrophysical phenomena. As illustration serve the terrestrial atmosphere and the gas in the Galaxy. (auth)

7039 GALACTIC NEUTRINO SOURCES AND COSMIC RAYS. Pallister, W. S.; Wolfendale, A. W. (Univ. of Durham, Eng.). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 273-283(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

The scope is three-fold: to review the status of the detection of cosmic ray muon neutrinos of atmospheric origin, to make an estimate of the cosmic ray background in the Brookhaven solar neutrino experiment and to briefly examine the possibility of detecting neutrinos from supernovae and collapsing stars in the galaxy. (auth)

7040 HIGH-RESOLUTION MAP OF THE ORION NEBULA REGION AT FAR-INFRARED WAVELENGTHS. Fazio, G. G. (Harvard Coll. Observatory, Cambridge, MA); Kleinmann, D. E.; Noyes, R. W.; Wright, E. L.; Zeilik, M. II.; Low, F. J. Astrophys. J., Lett.; 192: No. 1, L23-L25(15 Aug 1974).

A high angular resolution (1') map of Ori A (M42) at an effective wavelength of 69 μ shows two components: a small (<1') intense source at the position of the Kleinmann--Low infrared nebula and

an extended emission similar to the 11-cm aperture-synthesis map of Webster and Altenhoff. Nearby sources also detected include the nebula M43 and the molecular cloud OMC-2. (auth)

7041 POSSIBLE IDENTIFICATION OF THE 10-MICRON SILICATE FEATURE. Day, K. L. (Univ. of Arizona, Tucson). Astrophys. J., Lett.; 192: No. 1, L15-L17(15 Aug 1974).

An amorphous magnesium silicate has been synthesized which has an absorption band very similar to the material(s) causing the interstellar 10-μ absorption feature. The relation between this substance and the matrix material of carbonaceous chondrites is discussed. (auth)

7042 SPECTRA OF MARKARYAN GALAXIES. IV. Arakelyan, M. A.; Dibai, E. A.; Esipov, V. F. (Astrophysical Observatory, Moscow). Astrophysics (Engl. Transl.); 8: No. 1, 17-22 (1972).

Translated from Astrofizika; 8: No. 1, 33-42(1972).

The results of spectral observations of 85 objects from the lists of galaxies with ultraviolet continua are presented. Emission lines were detected in the spectra of 70 objects. (auth)

7043 MORPHOLOGY OF GALAXIES IN CLUSTERS. I. The Cluster A262. Kalloglyan, A. T. (Astrophysical Observatory, Moscow). Astrophysics (Engl. Transl.); 8: No. 1, 23-27(1972).

Translated from Astrofizika; 8: No. 1, 43-51(1972).

Photographs taken with the two-meter telescope of the Tautenburg observatory were used to determine the morphological types of galaxies in the cluster Abell 262 down to 16.8 m. Spirals accounted for 75% of all the classified galaxies; only 20% were elliptic or lenticular. Of the spirals, 80% were normal, the remainder barred. There is a clearly defined segregation of galaxies according to types: the outer regions of the cluster consist almost entirely of spiral galaxies. The variance of the integral magnitudes of the barred galaxies is half that of the normal spiral galaxies. This is because bars are observed preferentially in the galaxies that are absolutely brighter. In the cluster, the fainter galaxies do not predominate as one moves away from the center. However, galaxies that are brighter than the average are observed at some distance from the center of the cluster. (auth)

7044 PHASE MIXING OF THE SECOND KIND IN STELLAR SYSTEMS. I. Osipkov, L. P. (Leningrad State Univ.). Astrophysics (Engl. Transl.); 8: No. 1, 80-84(1972).

Translated from Astrofizika; 8: No. 1, 139-147(1972).

Different kinds of phase mixing in stellar systems are discussed. Mixing of the first kind is defined as the attainment by the system of a state that is stationary in a regular force field. The mixing is said to be strong in the case of a violently nonsteady initial state and weak in the case when small fluctuations of the phase density are damped. Application of the Hopf–Krylov theory shows that weak mixing probably takes place very slowly in stellar systems. Mixing of the second kind is the phase analog of differential rotation and it is manifested in a systematic change in the mean phase velocity of a star on the transition from one isolating integral surface to another. (auth)

7045 THREE-COLOR PHOTOMETRY OF SA 94 IN THE RGU SYSTEM. Schaltenbrand, R. A. (Univ., Basel). Astron. Astrophys., Suppl. Ser.; 18: No. 1, 27-45(Oct 1974).

Roughly 1350 stars, down to a limiting magnitude in G of 19.0 were measured in the RGU system on 18 plates taken at the 48″ Palomar Schmidt telescope. The size of the field in SA 94 is 2.03 sq. degrees. The calculation of the magnitudes, the corrections due to zero-point-error, field error and magnitude-equation, the separation of disc- and halo-stars, as well as the determination of density- and luminosity-functions were fully computerized. 493 objects among the field stars were identified as halo-stars, due to their uv-excess. The density-functions of halo and disc decreased monotonically and did not differ essentially from the ones in SA 54 which had about the same galactic longitude and a corresponding northern latitude. The luminosity-functions showed essentially the same gradients as the one valid for the solar neighborhood, but they lie below it, because of the negative density gradients. (auth)

7046 Hα EMISSION-LINE STARS IN THE LARGE MAGELLANIC CLOUD. I. A New Deep Survey. Bohannan, B.; Epps, H. W. (Univ. of California, Los Angeles). Astron. Astrophys., Suppl. Ser.; 18: No. 1, 47-79(Oct 1974).

A 5° square area centered on the Large Magellanic Cloud is surveyed for stellar objects with Hα in emission. Overlapping plate materials from two epochs, 1968 and 1970, are combined to produce a survey complete to R = 14.5. Finding charts are provided for 625 stars including 446 new identifications. A catalog is compiled which includes approximate positions, eye estimates of photographic continuum and emission densities for each epoch, and comments pertaining to individual stars. (auth)

7047 BERKELEY LOW-LATITUDE SURVEY OF NEUTRAL HYDROGEN. II. Contour Maps. Weaver, H.; Williams, D. R. W. (Univ. of California, Berkeley). Astron. Astrophys., Suppl. Ser.; 17: 1-249(Oct 1974).

490 contour maps showing antenna temperature as a function of velocity and latitude at a fixed longitude are presented. Each map, derived from the Berkeley Low-Latitude Survey of Neutral Hydrogen, covers the latitude range + 10° to −10° at intervals of 0.25°. The longitude range covered by the 490 maps is 10° to 250° at intervals of 0.5°. (auth)

7048 BERKELEY LOW-LATITUDE SURVEY OF NEUTRAL HYDROGEN. III. An Extension to Latitude ±30°; Profiles and Contour Maps. Weaver, H.; Williams, D. R. W. (Univ. of California, Berkeley). Astron. Astrophys., Suppl. Ser.; 17: 251-445(Oct 1974).

The Berkeley Low-Latitude Survey of Neutral Hydrogen has been extended to latitudes ±30° with a grid spacing of 2.5° in longitude and 0.5° in latitude. The data for the extension are here presented in the form of 8,036 frequency profiles and 99 contour maps. (auth)

7049 ASTROPHYSICS OF GASEOUS NEBULAE. Oesterbrock, D. E. Astronomy and Astrophysics. San Francisco; W. H. Freeman and Company (1974). 251p. $17.00.

The basic theory of the gaseous nebulae is presented, using both observational and theoretical results as illustrations. Topics covered include: photoionization equilibrium; thermal equilibrium; calculation of emitted spectrum; comparison of theory with observations; internal dynamics of gaseous nebulae; interstellar dust; H II regions; and planetary nebulae. (WDM)

Cosmology

Refer also to abstracts 5996, 6961, 6970, and 6981.

7050 COSMOLOGICAL CONSEQUENCES OF SPONTANEOUS VIOLATION OF DISCRETE SYMMETRY. Zel'dovich, Ya. B.; Kobzarev, I. Yu.; Okun, L. B. (Inst. of Applied Mathematics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 1, 3-11(Jul 1974). (In Russian).

In theories involving spontaneous violation of symmetry a domain structure of vacuum may be expected. This type of structure does not exist near a cosmological singularity, when the temperature exceeds the Curie point, but it should arise later during cosmological expansion and cooling. The properties of domain interfaces and of space with domains as a whole are discussed, as well as the cosmological expansion law in the presence of domains and the effect of domains on homogeneity of the universe at a late stage. (auth)

7051 EVOLUTION CRITERION FOR GRAVITATIONAL SYSTEMS. Haggerty, M. J. (Univ. of Texas, Austin); Severne, G. Bull. Cl. Sci., Acad. Roy. Belg.; 60: No. 2, 226-236(Feb 1974).

An evolution criterion is established for weakly-coupled gravitational systems without statistical inhomogeneities. Boltzmann's H decreases, without however approaching a limiting value. The evolution of the velocity distribution is towards a maxwellian, but the approach is deflected by an instability of the maxwellian distributions themselves. The velocity dispersion increases monotonically as new spatial correlations are created. (auth)

7052 QUASI-STATIC VERSION OF THE EINSTEIN COSMOLOGY. Horak, Z. (Technical Univ., Prague). Bull. Astron. Inst. Czech.; 25: No. 5, 287-292(1974).

The quasi-static superlarge version of the Einstein universe consisting of a large number of statistically distributed oscillating regions, similar to our own metagalaxy, has many remarkable features of the original Einstein universe. Yet, in addition, it explains the galactic redshift and is to be regarded as perfectly stable, since it is neither static nor evolutionary, but fluctuating about a stable equilibrium state. Thus it may be recognized as a fully satisfactory world model. (auth)

7053 AMPLIFICATION OF GRAVITATIONAL WAVES IN AN ISOTROPIC UNIVERSE. Grishchuk, L. P. (State Astronomical Inst., Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 3, 825-838(Sep 1974). (In Russian).

It is shown that in a nonstationary isotropic world weak gravitational waves can be amplified to a greater extent than permitted by the adiabatic law. A necessary (but not sufficient) amplification

condition is the existence of such a stage in evolution of the world for which the characteristic time of variation of the background metric is much smaller than the wave period. In an expanding universe the wave amplification is greater the greater the rate of world evolution differs from that predicted for matter with an equation of state $p = \epsilon/3$ and the earlier the wave was "triggered off." Superadiabatic amplification of gravitational waves signifies the possibility of graviton creation. An exclusive position is occupied by a "hot" isotropic world with $p = \epsilon/3$ in which superadiabatic amplification of gravitational waves and graviton creation are impossible. The nature of the back action of gravitons on the background metric is assessed. Graviton creation apparently excludes at least those of isotropic singularities in the vicinity of which $p > \epsilon/3$. (auth)

7054 QUANTUM EFFECTS IN WHITE HOLES. Zel'dovich, Ya. B.; Novikov, I. D.; Starobinskii, A. A. (Inst. of Applied Mathematics, Moscow). Zh. Eksp. Teor. Fiz.; 66: No. 6, 1897-1910(Jun 1974). (In Russian).

The influence of quantum effects (particle production near a singularity) on the external properties of a white hole is considered. It is shown that spontaneous particle production drastically modifies the properties of a white hole. In a hot model of the Universe a white hole becomes separated from the surrounding expanding matter of the Universe during the era $t \approx r_g/c$, where r_g is the gravitational radius which an external observer measures after separation of the white hole. If extremely artificially chosen initial conditions are excluded, the white hole will either explode with practically no delay in the era $t \lesssim r_g/c$ or will not explode at all. It seems highly improbable that white hole explosions can explain energy liberation in astrophysical phenomena. (auth)

7055 NEUTRINO COSMOLOGY. Bludman, S. A. (Univ. of Pennsylvania, Philadelphia). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 284-298(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

Cosmological data is reviewed suggesting that the universe may be open and dominated by neutrinos and gravitons rather than by baryons. The thermal history of the lepton era is investigated incorporating the effects of neutral currents, additional neutrinos, and a small neutrino mass. In the canonical version of big bang cosmology (equal numbers of neutrinos and antineutrinos), the neutrino number and energy density is, like that of photons, gravitationally insignificant unless the neutrino has a small mass (~10 eV). The neutrino sea can be cosmologically significant if it is degenerate (so that the net leptonic or muonic charge is nonzero) with $\sim 7 \times 10^5$ neutrinos (or antineutrinos) per cc. This density homogeneously spread out is still so low that even the most energetic cosmic ray protons will not be stopped, even if neutral currents exist with the usual weak strength. If these degenerate neutrinos have a small mass ~0.5 eV, they will condense into degenerate neutrino superstars of the size and mass of galactic clusters. If neutral currents make the $(e\nu)(e\nu)$ coupling 5 × greater than what it is in V-A theory, nucleosynthesis commences a little earlier than conventionally assumed. This increases the cosmological ^{4}He abundance predicted only slightly from Y = 0.27 to Y = 0.29. The effect of neutral currents on neutrino processes in stars is reviewed. (auth)

Planetary Phenomena

Refer also to abstracts 5598, 7022, and 7398.

7056 SPECTRAL LINE FORMATION IN SPHERICALLY SYMMETRIC AND EXPANDING ATMOSPHERES. Kunasz, P. B. Boulder, CO; Univ. of Colorado (1974). 233p. University Microfilms Order No. 74-22,364.

Thesis (Ph. D.).

A study is made of spectral line formation in static and radially flowing spherically symmetric atmospheres for which the ratio of photon mean free path to radius of curvature is large for at least some frequencies in the line. Since two distinct numerical techniques are used for the static and flowing atmospheres the two problems are discussed separately. (Diss. Abstr. Int., B)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 7030 and 7102.

7057 (AD-779675) ROCKET INSTRUMENTATION FOR AURORAL ZONE ABSORPTION MEASUREMENTS: BLACK BRANT 17.110-1 AND BLACK BRANT 17.110-2. Howlett, C.; Lebaron, G. K.; Bell, R. J. (Utah State Univ., Logan (USA)). Jan 1974. Contract F19628-72-C-0255. 146p. (AFCRL-TR-74-0057). NTIS $4.75.

Two Black Brant rockets were flown from the Churchill Research Range, Manitoba, Canada, to study an auroral zone absorption (AZA) event. The first payload (Black Brant 17.110-2) was launched 24 September 1972 into an AZA event producing 1.5 db of absorption on a 30-MHz polar riometer. The second payload was launched the next day into quiet conditions. Each payload contained instrumentation to measure ionizing sources, the resulting ionization, and minor constituents. Both payloads were developed and instrumented at Space Science Laboratory at Utah State University under contract with Air Force Cambridge Research Laboratories. (auth)

7058 (AD-780502) TOTAL ELECTRON CONTENT MEASUREMENTS FROM ATHENS, GREECE STATION. Final Report, 1 March–1 December 1970. Anastassiadis, M. A. (Athens Univ. (Greece)). 31 Jan 1971. Contract F61052-70-C-0012. 20p. (AFCRL-TR-74-0242). NTIS $4.00.

The diurnal and seasonal variations of ionospheric total electron content were studied during 1966, using signals from the explorer 22 satellite. (GRA)

7059 (AD-780552) ANGULAR DISTRIBUTION OF SPREAD-F RETURNS FROM AN ARTIFICIALLY MODIFIED IONOSPHERE. Final Technical Report, January 1973–February 1974. Allen, E. M.; Thome, G. D.; Rao, P. B.; St. Germain, R. L. (Raytheon Co., Sudbury, Mass. (USA)). Feb 1974. 40p. (RADC-TR-74-114-PT-2). NTIS $3.25.

A 32 element hf phased array has been used to study the angular spectrum of spread-F returns from an ionosphere modified by the powerful radio frequency heater transmitter at Platteville, Colorado. The diagnostic radar is a coherent pulse system which provides an angular resolution of 2.7 degrees in azimuth and elevation at the midband frequency of 7.5 MHz, a range resolution of 30 km, and a Doppler resolution of 0.08 Hz. The results are presented in the form of sky maps (brightness versus azimuth and elevation) of the returns as a function of group delay Doppler shift, polarization, and sounding frequency. The principal result is that the returns which suffer the greatest group delay at a given sounding frequency come from a direction looking up the Earth's magnetic field and exhibit negative Doppler shift. (GRA)

7060 (AD-780553) THEORETICAL STUDIES OF IONOSPHERIC HEATING BY POWERFUL RADIO WAVES. Final Technical Report, January 1973–February 1974. Meltz, G.; Holway, L. H. Jr. (Raytheon Co., Sudbury, Mass. (USA)). Feb 1974. 67p. (RADC-TR-74-114-PT-3). NTIS $3.75.

In addition to the communication applications of FAS, ionospheric heating by powerful radio waves holds promise for establishing new techniques in the aeronomy of the D, E, and F regions. This report discusses the observed phenomena associated with the absorption of intense hf waves in the context of present theoretical understanding. The authors develop the fundamentals of ionospheric heating theory and apply it to the prediction of large scale electron temperature and density changes in both the D and F layers. Generation of gravity waves by heating is also examined. (GRA)

7061 (AD-780659) INFRARED RADIANCE MODEL FOR THE AURORALLY DISTURBED ATMOSPHERE. Final Report, 1 August 1971–31 August 1973. Bishop, R. H.; Han, R. Y.; Shaw, A. W.; Megill, L. R. (Utah State Univ., Logan (USA)). 31 Aug 1973. 149p. (AFCRL-TR-73-0527). NTIS $10.50.

Recently, auroral observations have indicated the strong enhancement of certain infrared bands during periods of auroral activity. A theoretical model has been created in order to study the infrared processes associated with the aurora. The quantitative results of this study depend upon a thorough knowledge of the rates of all processes involved. Some of the rate constants are well known while for others only the crudest approximation is made. Qualitatively, however, results indicate that certain infrared bands of CO_2, N_2O, NO, and NO^+ are strongly enhanced during periods of auroral activity. This is primarily the result of two basic energy exchange mechanisms. The energy deposited by the primary auroral electron flux goes into increasing the internal energy of N_2, O_2, and O. In addition to energetic auroral particles as an energy source, electric fields are also considered. Qualitatively the results are similar except that the energy tends to be deposited at altitudes somewhat higher than in direct precipitation processes. (GRA)

7062 (AD-781094) STIMULATED SKYGLOW. Final Technical Report, 1 August–31 December 1973. Archer, D. H.; Tarr, P. W. (Mission Research Corp., Santa Barbara, Calif. (USA)). Jan 1974. Contract F30602-71-C-0374. 73p. NTIS $3.75.

The report describes the development of a code, called Arctic, that is suitable for the study and analysis of auroral data. The code inputs a flux spectrum of primary electrons, incident on or in the atmosphere, with a specified magnetic dip angle and initial pinch angle, and computes the detailed energy deposition and partition in the atmosphere. The deposition subroutine is coupled to a chemistry and radiation subroutine with the result that the optical/infrared emission, as functions of altitude and time, are then determined. The code is essentially complete, except for certain refinements, and has been run for the case of a hypothetical class II + aurora. (auth)

7063 (AD-781178) IONOSPHERIC HEATING ANALYSIS. Final Technical Report. Gordon, W. E.; Carlson, H. C. (Rice Univ., Houston, Tex. (USA)). Apr 1974. Contract F30602-72-0278. 107p. (RADC-TR-74-124). NTIS $4.50.

Enhancements of various features of the incoherent scatter spectrum are observed when the ionosphere is illuminated with powerful, high-frequency radio waves. The radio waves excite plasma instabilities producing lines or more complex spectral features near the local plasma frequency, at the local ion-acoustic frequency, near the local gyrofrequency and twice the gyrofrequency. The enhancements occur in a thin slab as observed by the incoherent scatter radar and at both upshifted and downshifted frequencies with respect to the probing radar frequency. The enhancements are observed to vary with time when the high-frequency transmitter that produces the radio wave excitation is held at constant power, and to vary with time as the high-frequency transmitter is turned on or off. (GRA)

7064 (AD-781201) PHYSICS OF THE UPPER ATMOSPHERE. Katasev, L. A. Translated from Tr., Inst. Eksp. Meteorol.; 24: vp(1971). 136p. (FSTC-HT-23-591-73). NTIS $10.00.

By means of bennet type mass-spectrometers installed in meteor-rockets MR-12, in 1969, investigations were carried out into ion composition at altitudes of the E region in mid and polar latitudes. In the latitudes, mass-spectrometric measurements were carried out in a program of complex investigation of the effects due to solar bursts. Among other experiments, two rocket launches with ion mass-spectrometers were carried out. A comparison was made of the composition in concentrations of ions before and during a magnetic storm accompanying a solar burst. (auth)

7065 (AD-781275) STUDIES OF AURORAL SIMULATION. Final Report, 15 May–31 December 1973. Tarr, P. W.; Archer, D. H.; Utterback, N. G. (Mission Research Corp., Santa Barbara, Calif. (USA)). 11 Apr 1974. Contract F30602-71-C-0374. 103p. (MRC-R-122). NTIS $4.50.

The final report describes an effort, under the simulation program, to understand infrared backgrounds in an aurorally-disturbed environment. A large part of this effort has been devoted to the development and use of a code, called Arctic, that is suitable for the study and analysis of auroral data. The code inputs a flux spectrum of primary electrons, incident on or in the atmosphere, with a specified magnetic dip angle and a given initial pitch angle distribution, and computes the detailed energy deposition and partition in the atmosphere. Scattering of the primary electrons is provided for in the deposition subroutine by two options: one, that allows for the full effects of range variance, gives excellent agreement with observations in nitrogen; the other, that is considerably more economical to use, assumes mean scattering only. (GRA)

7066 (AD-781750) IONOSPHERIC ELECTRON CONTENT AND RADIO SCINTILLATIONS DURING MAGNETOSPHERICALLY QUIET PERIODS IN 1970–1971. Hawkins, G. S. (Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass. (USA)). 28 Mar 1974. 33p. (AFCRL-ERP-472; AFCRL-TR-74-0160). NTIS $3.25.

The World Data Center of the National Academy of Sciences selected two periods in February and December 1970 when the magnetosphere was particularly quiet so that the effects of magnetic disturbances on ionospheric and geophysical phenomena could be studied by their absence. These WDC "quiets" were studied using AFCRL data on scintillations at 136 MHz from ATS-3 and measures of total electron content. An additional period in January 1971 was also selected when the magnetic indices were abnormally low, with the minimum daily KP value reaching 0.0. (GRA)

7067 (AD-781815) ICECAP 73: A SUMMARY REPORT. White, R. K. (Stanford Research Inst., Menlo Park, Calif. (USA)). May 1973. Contract DNA001-72-C-0143. 27p. (SRI-EGU-TN-1928-2). NTIS $3.25.

The report summarizes the activities of the icecap operation at the polar flat rocket range, Alaska, in March–April 1973. The rocket launchings are described briefly, and the scientific ground support operations are indicated. The operation comprises a part of the auroral research program of the defense nuclear agency. (auth)

7068 (AD-781818) MODEL FOR FIELD ALIGNED SCATTERING (FAS) FROM HEATER MODIFIED IONOSPHERE. Final Technical Report (Part 1), January 1973–February 1974. Report on Ivory Coral Model Development. Rao, P. B.; Thome, G. D. (Raytheon Co., Sudbury, Mass. (USA)). Feb 1974. Contract F30602-73-C-0154. 40p. (RADC-TR-74-114-PT-1). NTIS $3.25.

The paper describes the current status in the development of the on-frequency scattering model. The presentation adopts a format that is intended to orient the model toward eventual application for systems evaluation. The physical description of the scattering medium which constitutes a basic component to the model is derived from the observations currently at hand. The radar scattering properties of the disturbance are described physically by presenting the concepts of aspect sensitivity and surface of specularity for scattering by way of an optical analogy. The mathematical part contains two levels of sophistication in the model treatment. The simpler approach offers an approximate analytic solution and thereby a first-order systems evaluation capability without resorting to a complex computer code. Finally, a flow chart is given for computer adaptation of the scattering model in its general form. (auth)

7069 (AD–782019) RESEARCH IN IONOSPHERIC AND AIRGLOW PHENOMENA. Final Report, 1 September 1970–31 August 1973. Tuan, T. F. (Cincinnati Univ., Ohio (USA). Dept. of Physics). 16 Nov 1973. Contract F19628-71-C-0028. 111p. (AFCRL-TR–74-0011). NTIS $4.50.

The research in the final report may be divided into two areas. The first area deals with dynamic disturbances in the upper ionosphere. This includes (1) an analysis of a particular fairly well established TID in both the northern and the southern hemisphere, (2) the effect of atmospheric gravity waves on the mid-latitude ionosphere, (3) the effect of particle precipitation on the polar ionosphere and universal time control. The second area deals with a detailed investiagtion into the possible origin of anomalous auroral sounds. After exhaustive analysis into every conceivable cause it was felt that brush discharge with aurorally associated electric fields is the most likely explanation. (GRA)

7070 (AD–782101) ANALYTICAL AND LABORATORY STUDIES ON UPPER ATMOSPHERIC ENERGY TRANSFER PROCESSES. Final Report, 15 July 1970–15 July 1973. Kummler, R. H.; Jamshidi, E.; Krieger, B.; Lalas, D. P.; Fisher, E. R. (Wayne State Univ., Detroit, Mich. (USA)). Aug 1973. Contract F19628-70-C-0284. 124p. (AFCRL-TR–73-0605). NTIS $4.50.

The vibrational temperature of N_2 in the E and F regions of the atmosphere has been calculated. Excitation processes included O(singlet D) quenching by N_2, N + NO, and electron–N_2 collision. Loss processes included vibration–vibration exchange to CO_2, vibration–translation energy transfer by oxygen atoms and diffusion. The Shimazaki–Keneshea code was used. The rate of dissociation of oxygen molecules was calculated including vibration–vibration and vibration–translation processes and comparison to experimental data was made. Chemiluminescence was observed for H + NO_2, O + C_2H_4 and CO + OH systems in the visible and near infrared regions using a discharge flow system. The vibrational temperature of N_2 was measured using an electron beam with and without CO. (GRA)

7071 (AD–782276) PROCEEDINGS OF THE PRAIRIE SMOKE V rf MEASUREMENTS DATA WORKSHOP HELD ON 8–9 NOVEMBER 1973. Fialer, P. A. (Stanford Research Inst., Menlo Park, Calif. (USA)). Mar 1974. Contract N00014-70-C-0413. 181p. NTIS $5.50.

Project Prairie Smoke is a series of coordinated field experiments investigating the effects of hf heating on the ionosphere. These proceedings describe results from various experiments conducted during the Prairie Smoke 5 test series. Prairie Smoke was carried out during the period 10 September to 10 October 1973. Its primary purpose was to collect data regarding the efficiency of ionospheric heating, including the dependences of the various observable effects of heating on the frequency, power, and modulation of the heater. (GRA)

7072 (BUP-66) PRECIPITATION OF >115 keV PROTONS IN THE EVENING AND FORENOON SECTORS IN RELATION TO THE MAGNETIC ACTIVITY. Hauge, R.; Soeraas, F. (Bergen Univ. (Norway). Dept. of Physics). May 1974. 30p. Dep. NTIS (US Sales Only) $4.50.

Satellite data are presented on auroral protons > 115 keV in the evening and forenoon sectors from the northern hemisphere only. In the forenoon sector there is a weak but steady precipitation at $\Lambda \approx 75°$ during quiet conditions. This precipitation is situated at higher invariant latitudes at local noon than at local dawn and can probably be ascribed to the high energy tail of the polar cleft protons. During moderately disturbed conditions, especially during the recovery phase of geomagnetic storms, there are some precipitation events at $\Lambda \approx 65°$. During very disturbed conditions these two precipitation zones in the forenoon sector seem to merge. In the evening sector a rather sharp equatorward boundary of the main precipitation, at $\Lambda \approx 69°$ during quiet conditions, varies rather smoothly from pass to pass. South of this, at invariant latitudes around 62°, there is a steady weak drizzle from the radiation belt. Due to a longitudinal effect this drizzle shows a diurnal variation. The equatorward boundaries of the main precipitation at both local times move equatorward with increasing ring-current strength. When Dst gets less than about –100 nT, the poleward boundaries move equatorward too. From an attempt to reveal some of the substorm-dependent changes of the precipitation it is found that an equatorward shift of the precipitation areas takes place during, or just prior to the substorm expansive phase, accompanied by a large intensity increase in the evening sector, whereas the recovery phase is linked. With a poleward expansion of the precipitation at both local times. A significant difference between the position of the equatorward boundary in the evening sector and the inner boundary of the ring current in the midnight sector during similar geomagnetic conditions (Dst ≈ –50 nT) indicates that there might be a proton population at the inner boundary of the ring current which is not subject to precipitation loss in the evening sector. (auth)

7073 (COM-74-50087-353) IONOSPHERIC DATA. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Jan 1974. 143p. (NOAA-ISPDA-FA-353). National Climatic Center, Asheville, N. C. 28801 $1.45.

Beginning with the January 1973 issue the contents of Ionospheric Data have been changed from the traditional publication of all monthly median data available at the time of issue, regardless of the data of observation. The publication now contains monthly medians only for the same month the publication is issued. For example, the January 1974 issue includes all the data available for January 1973 and any previously unpublished data for January from earlier years. Also published are detailed data for the same month from an exemplary station. Wallops Island (Washington) including daily-hourly values of all characteristics, F-plots for regular world days, and an N(H) contour graph. As timely information, there is included selected ionospheric data for a retrospective world interval, when appropriate. Also given is information on ionospheric data recently received at World Data Center A for solar-terrestrial physics and other information on availability of data from the WDCS. (GRA)

7074 (NICP-7303) FULL WAVE SOLUTION FOR IONOSPHERIC WAVE PROPAGATING THROUGH A MULTI-ION PLASMA. Bjoentegaard, G. (Norske Institutt for Kosmisk Fysikk, Oslo). Oct 1973. 58p. Dep. NTIS (US Sales Only) $6.00.

Full wave calculations of wavefields, reflection and transmission coefficients, ray direction, and group velocity of electromagnetic waves in the ionosphere are treated. A FORTRAN IV computer program which calculates these quantities is presented, emphasizing user instructions. The method of computation is based on a full-wave procedure presented by Pittaway and Jespersen, and the program description on a description given by Pittaway and Smith. In the present case, electrons and ions are assumed to have a Boltzman distribution and the wave fields to be so small that the perturbations from these distributions are small. Positive and negative ions are also considered. The full wave technique is suited for treatment of wave frequencies from

ELF up to HF, and for a variety of propagation conditions, such as nighttime propagation at frequencies below the gyrofrequency under conditions conducive to transition of the whistler mode, daytime equatorial propagation or propation at frequencies above the gyrofrequency but without F-layer penetration, propagation of the downgoing whistler wave and F-layer penetration by upgoing waves. (NO)

7075 (WRE-TN-A-243(AP)) FINGER LANCE: A SEMI-AUTOMATIC h.f. DIRECTION OF ARRIVAL AND DOPPLER MEASURING SYSTEM FOR THE STUDY OF LOCAL TRAVELLING IONOSPHERIC DISTURBANCES. Spragg, R. D. (Weapons Research Establishment, Salisbury (Australia)). Mar 1974. 33p. Dep. NTIS (US Sales Only) $4.75.

Travelling ionospheric disturbances are responsible for significant errors in high-frequency direction finding, especially at short ranges. Research in this area is concentrated on determining the magnitude, velocity, and spatial correlation of these disturbances with a view to improving the accuracy of high-frequency direction finding. In support of the research program a semi-automatic high frequency direction of arrival measuring system has been developed. This system automatically measures the direction of arrival, associated Doppler shifts and apparent path length of up to four transmissions propagated via the ionosphere. (auth)

7076 (WRE-TN-A-249(AP)) EVIDENCE OF FRONTAL STRUCTURES IN NONBLANKETING SPORADIC-E LAYERS. Clarke, R. H. (Weapons Research Establishment, Salisbury (Australia)). Mar 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

Two radiowave-sounding techniques have been refined in order to examine the structure of partially transparent (i.e., nonblanketing) sporadic-E layers. Firstly, a hf interferometer has been developed to provide angle-of-arrival data on occasions when the downcoming signal arrives from a reasonably well-defined direction. On one occasion, records covering the 2- to 6-MHz frequency band provide good evidence that a sporadic-E layer comprised three frontal clouds, each aligned in a north–south direction though possessing different peak electron concentrations. Secondly, an ionosonde has been adapted to record ordinary- and extraordinary-mode traces on alternate ionograms. One ninety-minute sequence of such ionograms recorded in rapid succession indicates that the observed temporal variations in the ordinary- and extraordinary-mode blanketing and critical frequencies of the E_s-layer were caused by the horizontal movement of frontal overdense clouds of ionization on that occasion. (auth)

7077 ELECTRIC FIELD MEASUREMENTS. Wescott, E. M. (Univ. of Alaska, Fairbanks). pp 73-78 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

The electric field can be measured directly by the long antenna or double probe technique where the potential drop between two conductors separated a distance d (usually of the order of 10 m) is recorded by a very high impedance voltmeter. These have been flown on rockets and satellites very successfully. Ionospheric electric fields have been implied from measurements made from balloons using somewhat shorter booms and conducting spheres as probes. Barium ions released from rockets create visible ion clouds which can be tracked optically, and this technique has produced very interesting data from approximately 100 releases in the auroral zone and polar cap. (IAA)

7078 AURORA IN THE POLAR CAP DURING DECEMBER 1971, AS SEEN BY THE ISIS-2 SCANNING AURORAL PHOTOMETER. Anger, C. D. (Univ. of Calgary, Alberta). pp 617-644 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

An unusual auroral display was observed in the polar cap by the ISIS-2 scanning auroral photometer on several days following the geomagnetic storm of December 16-18, 1971. On December 20, nearly the entire polar cap was filled with discrete and diffuse aurora, with most of the features sun-aligned. The period during which the polar-cap aurora was most pronounced was also a time when there was no evidence of substorm activity in the midnight sector and Kp values were very low. However, at times of equally low magnetic activity before this period polar-cap auroras were not observed. (auth)

7079 AURORAL-ZONE X-RAY MEASUREMENTS AT LARGE LONGITUDINAL DISTANCES. Kremser, G.; Kirsch, E. (Max-Planck-Institut fuer Aeronomie, Lindau, Ger.). pp 645-652 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

A review is presented of results obtained in simultaneous x-ray measurements conducted by Maral et al. (1972) in Scandinavia and Iceland involving a longitudinal distance of 2000 km. Other simultaneous measurements reviewed, which were made by Kremser et al. (1972) in Scandinavia and Greenland, involved a distance of 3000 km. The data provide information concerning the deviation of individual events from the general scheme obtained by a statistical approach. (IAA)

7080 PARALLEL ELECTRIC FIELDS. Robar, J. D.; Kavadas, A.; Koehler, J. A. (Univ. of Saskatchewan, Saskatoon). pp 683-695 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Preliminary electric field measurements obtained from two rocket flights into auroral substorms have indicated that electric field components parallel to the magnetic lines can exist between 100 and 300 km with strengths of the order of tens of millivolts/meter. The development of the parallel electric field was associated with a relocation of an auroral arc and electrojet. A correlation between parallel electric fields, auroral luminosity, electron precipitation, and magnetic field measurements suggested that, at times, the observed parallel electric field may have been due to a polarization of the plasma above auroral forms in the region where low-energy electrons are attenuated. (auth)

7081 DYNAMICS OF EQUATORIAL SPREAD F. Beer, T. (Univ. of Ghana, Legon). Aust. J. Phys.; 27: No. 3, 391-400 (Jun 1974).

A theory is proposed to explain the occurrence of spread F in the equatorial ionosphere. It is envisaged as a multistage process involving movement of ionization drift with atmospheric gravity waves that results in spatial resonance, consequent enhancement of ionization irregularities and eventual strong vertical layering ("pousse-café" effect), which is characterized by the appearance of satellite traces on ionograms; subsequent development of instability in the discrete layers and mixing of the ionization by means of the Rayleigh–Taylor criterion, which leads to blurring of the satellite traces and the observation of spread F. The arguments for the theory are closely related to experimental observations. (auth)

7082 AIRGLOW EXCITATION BY PRECIPITATING LOW-ENERGY ELECTRONS. Takayanagi, K. (Tokyo Univ.). Tokyo Daigaku Uchu Koku Kenkyusho Hokoku; 10: No. 2, 235-246(Apr 1974). (In Japanese).

Excitation rate is calculated for various line emissions (λλ 1304, 3914, 5577, 6300, 8446) in the upper atmosphere by precipitating low-energy (10 to 100 eV) electrons. The oxygen red line (λ 6300) becomes stronger as the incident energy becomes lower, while the first negative band of the nitrogen molecule (λ 3914) is strong only when the incident energy is high. The ultraviolet line of atomic oxygen (λ 1304) is the strongest in most cases. (auth)

7083 ELECTRON PRECIPITATION AT AN AURORAL LATITUDE: SASKATOON, L = 4.4. I. Photometer, Magnetometer, and Radiowave Data. Kahn, Z. M.; Manson, A. H. (Univ. of Saskatchewan, Saskatoon). Can. J. Phys.; 52: No. 19, 1872-1878(1 Oct 1974).

A study of the quiet and disturbed lower ionosphere (60 to 100 km) near solar maximum years (1970–1971) has been carried out at Saskatoon (52°N, 106°W, L = 4.4) using a variety of techniques: a 5577 Å photometer, a magnetometer, a "partial reflection radiowave system" (2.2 MHz), and an all-sky camera. Good correspondences between local and planetary magnetic disturbances and the green line intensity I(15577 Å) have been found. Radiowave data, ordered in terms of I(5577 Å), have been used in seasonal epoch analyses for the four seasons. It is shown that after the photometric maxima near geomagnetic midnight, ionospheric disturbances below 80 km continue to increase in magnitude towards sunrise. They are evident until at least noon the following day. For a given level of I(5577 Å), the ionospheric disturbance (<90 km) is largest during the night hours in summer and winter; and after sunrise, largest in winter and fall months. There is good general correspondence between these results, and fluxes of precipitated electrons measured by satellite techniques. (auth)

7084 ELECTRON PRECIPITATION AT AN AURORAL LATITUDE: SASKATOON, L = 4.4. II. Fluxes of Precipitating Electrons. Manson, A. H.; Khan, Z. M. (Univ. of Saskatchewan, Saskatoon). Can. J. Phys.; 52: No. 19, 1879-1884 (1 Oct 1974).

Measurements of ambient electron densities have been made by the differential absorption experiment, on a number of aurorally disturbed nights in 1971. The measured values of the intensity of the green line (5577 Å) emission, and of the ambient electron den-

sities, are then compared with theoretical estimates of these two variables. An exponential energy spectrum is used in the calculation, and fluxes of precipitated electrons (>40 keV) and values for the e folding energies (E_0) thereby become available. Comparisons of mean values with satellite measurements made under similar magnetic conditions, show good agreement. Calculations are also made for two specific nights, (January 26, 28, 1971). Characteristic energies are typically 5 keV during the maximum of the magnetic and photometric disturbances, and increase to values of 10 to 15 keV near sunrise when the ionospheric disturbance (<90 km) is greatest. The calculation is shown to be sensitive to changes in characteristic energy of the spectrum. (auth)

7085 COSMICAL GEOPHYSICS. Egeland, A.; Holter, O.; Omholt, A. Scandinavian University Books. Oslo; Universitetsforlaget (1973). 360p. $20.00.

Topics covered include: solar radiation and particle emission; the geomagnetic field; the neutral atmosphere; formation of the ionosphere; airglow; solar wind; magnetosphere; motion of charged particles in the magnetosphere; particle observations in the magnetosphere; auroral particles; electrodynamics of the ionosphere, perturbations of the geomagnetic field; auroral morphology; particle precipitation; auroral-zone x rays; waves in plasmas; radiowave propagation; radio experiments; micropulsations, whistlers, and vlf emissions; scattering of radio waves from auroral ionization; and cosmic rays. (WDM)

7086 LOW-ENERGY AURORAL ELECTRONS. Sharp, W. E.; Hays, P. B. (Univ. of Michigan, Ann Arbor). J. Geophys. Res.; 79: No. 28, 4319-4321(1 Oct 1974).

A measurement of the low-energy auroral electron flux distribution between 0.5 and 80 eV reveals structure between 0.5 and 10.0 eV. The structure is due to the thermal electron Maxwellian distribution and electron energy loss to thermal electrons, molecular nitrogen, and atomic oxygen. Some physical process in the auroral plasma causes the deduced loss function to differ from theory. Reasonable agreement is obtained between calculated and measured N_2 second positive emission. (auth)

7087 NEAR-SIMULTANEOUS MEASUREMENT OF LOW-ENERGY ELECTRONS BY SOUNDING ROCKET AND SATELLITE. Rearwin, S. (Univ. of California, San Diego, La Jolla); Hones, E. W. Jr. J. Geophys. Res.; 79: No. 28, 4322-4325(1 Oct 1974).

An auroral sounding rocket was launched from Fort Churchill at 0453 UT on April 24, 1968. At the time of the rocket flight the Vela 3B satellite was passing through the magnetotail plasma sheet at very nearly the same magnetic local time (~2200 MLT). Electron spectra obtained from experiments on these vehicles are well described by central Maxwell–Boltzmann populations, with indications of a high-energy tail; the satellite spectra also suggest the presence of a low-energy tail. The higher-temperature spectra measured on the rocket may be derived from the satellite spectra by adiabatic compression. (auth)

7088 IS THE RED ARC A GOOD INDICATOR OF IONOSPHERE–MAGNETOSPHERE CONDITIONS? Nagy, A. F. (Univ. of Michigan, Ann Arbor); Brace, L. H.; Maynard, N. C.; Hanson, W. B. J. Geophys. Res.; 79: No. 28, 4331-4333(1 Oct 1974).

Weak red arcs were observed on the two consecutive nights of July 12–13 and July 13–14, 1969, at Richland, Washington, whereas no red arcs were detectable on the nights preceding and following the observations. Satellite (Ogo 6) data of electron temperature and density, low-frequency (4 to 16 Hz) ac electric field, and suprathermal electron flux corresponding to the conjugate region of Richland show no significant variations during these days. The data show elevated electron temperatures (~3500°K) and enhanced low-frequency ac noise levels at the expected red arc position in the neighborhood of the density trough, as indicated by previous observations. The data appear to indicate that the optical criterion of red arc occurrence would lead to the conclusion of significantly different ionosphere–magnetosphere conditions during these four nights, whereas the more detailed in situ data show that the conditions were very similar. (auth)

7089 HIGH-LATITUDE IRREGULARITIES IN THE TOP SIDE IONOSPHERE BASED ON ISIS 1 THERMAL ION PROBE DATA. Sagalyn, R. C. (Air Force Cambridge Research Labs., Bedford, MA); Smiddy, M.; Ahmed, M. J. Geophys. Res.; 79: No. 28, 4252-4261(1 Oct 1974).

Thermal ion density irregularities at high latitudes have been investigated by using results from the spherical electrostatic analyzer flown on the polar-orbiting satellite Isis 1. The size of the irregularities is found to be highly variable, dimensions typically ranging from 1 to 140 km. Results from 3500 orbits in the top side ionosphere during the first year of operation have been examined. The daily and seasonal behavior of the equatorial boundary of the high-latitude irregularity zone and its dependence on magnetic activity have been established for the northern and southern hemispheres. The daily variation in the location of the boundary of the irregularity zone is found to be 14° ± 2° for any level of magnetic activity; the boundary is at the highest latitude near local noon. The irregularities consistently extend across the pole; there is no upper boundary. Systematic differences are found in the mean location of the equatorial boundary in the northern and southern hemispheres. In the south the boundary is on the average 4.8° ± 0.6° closer to the pole than in the north. Good agreement is found between the direct measurements of the irregularity boundary and scintillations, severe top side spread F and ≤ 300-eV electron precipitation boundaries, and trough and plasmapause positions on the night side. Significant differences found to exist between the irregularity boundary and plasmapause positions on the day side are considered to be due to their different origins. (auth)

7090 STRUCTURE OF THE PROTONOSPHERE ABOVE ARECIBO. Hagen, J. B. (Arecibo Observatory, Puerto Rico); Hsu, P. Y. S. J. Geophys. Res.; 79: No. 28, 4269-4275(1 Oct 1974).

Preliminary results are presented from protonospheric observations made with the considerably increased system capability at Arecibo. The least squares technique for interpreting the experimental autocorrelation functions is discussed together with various assumptions that must be made to deduce physical parameters from the data successfully. Typical data show steadily increasing temperatures both day and night up to 2000 km. Composition data agree with diffusive equilibrium models, although for the daytime data, thermal diffusion and flux drag terms are important. (auth)

7091 6300-A INTENSITY VARIATIONS PRODUCED BY THE ARECIBO IONOSPHERIC MODIFICATION EXPERIMENT. Sipler, D. P.; Enemark, E.; Biondi, M. A. (Univ. of Pittsburgh). J. Geophys. Res.; 79: No. 28, 4276-4280(1 Oct 1974).

Nightglow 6300-Å intensity suppression and enhancement transients have been observed in conjunction with heating of the F region ionospheric electrons in Arecibo ionospheric modification experiments (IME). Ohmic heating of the electrons during X mode propagation of the heating wave results in a ~1.3% suppression of intensity, in semiquantitative agreement with the suppression predicted for $\Delta T_e \simeq 130°K$ (measured by the backscatter radar). The 6300-Å intensity enhancements (~6 R) associated with O mode propagation of the heating wave are far too large to be produced by ohmic heating (a value $\Delta T_e \sim 900°K$, about 5 times larger than the backscatter measured value, would be required), suggesting electron acceleration by strong plasma waves that are generated by the heating rf wave. The $O(^1D)$ lifetimes determined from the time constants of the 6300-Å intensity enhancement transients yield an F-region quenching coefficient $k(N_2) \simeq 6$ to 8×10^{-11} cm^3/s, in good agreement with the Platteville IME and with laboratory results. (auth)

7092 INITIAL ION COMPOSITION RESULTS FROM THE ISIS 2 SATELLITE. Hoffman, J. H.; Dodson, W. H.; Lippincott, C. R.; Hammack, H. D. (Univ. of Texas, Dallas). J. Geophys. Res.; 79: No. 28, 4246-4251(1 Oct 1974).

Isis 2 satellite carried, among other ionospheric instruments, an ion mass spectrometer designed to measure the composition of the ionosphere in the mass range 1 to 64 amu. The satellite, in a nearly constant 1400-km orbit, was launched on April 1, 1971. Examples of data show a wide variation in ion composition from 99% H^+ at night near the equator to greater than 95% O^+ (and N^+) in the daytime poleward of the plasmapause. Both H^+ and He^+ are observed to be streaming outward from the high-latitude regions with velocities of several kilometers per second (the polar wind), determined from phase shifts in roll modulation maximums between light and heavy ion species. During the August 1972 magnetic storm a unique ionosphere developed consisting of N^+ as the dominant species between 55° and 80° invariant latitude (above the plasmapause) and N_2^+, NO^+, and O_2^+ at the 10^3-cm^{-3} concentration level, whereas these molecular species are usually below the detection limit of 1 ion cm^{-3} in quiet times at this altitude. (auth)

7093 TRANSIENT PARALLEL ELECTRIC FIELDS FROM ELECTROMAGNETIC INDUCTION ASSOCIATED WITH MOTION OF FIELD-ALIGNED CURRENTS. Zmuda, A. J.; Potemra, T. A.; Armstrong, J. C. (John Hopkins Univ., Silver Spring, MD). J. Geophys. Res.; 79: No. 28, 4222-4226(1 Oct 1974).

Field-aligned currents always flow on the field lines in the ionosphere–magnetosphere coupled system, which includes the auroral oval, the polar cusp, and the plasma sheet. Parts or all of this system may move presumably in response to forces associated with the solar wind and its variations. The motion of the transverse magnetic field of the field-aligned currents leads to induced electric fields parallel to the main geomagnetic field.

The magnitude, direction, and spatial distribution of the E field depend on the velocity, magnitude, and configuration of the magnetic field of the field-aligned currents. Magnitudes of 10^{-5} to 10^{-3} V/m may exist for periods extending from a few seconds to nearly 1 hour. Reversals of polarity may be expected within the spatial distribution of the transient electric field. These E fields can exist anywhere in the volume of space influenced by the magnetic fields of the field-aligned currents, extending from the E region of the ionosphere to the outer magnetosphere. Acceleration or deceleration of charged particles may occur in different regions of the volume, effected by the magnetic field of the moving currents. Also transverse electric fields may be induced by the motion of the horizontal ionospheric currents that close the field-aligned currents. The totality of results at least suggests that this mechanism for producing induced electric fields may be one of major importance in studies of the transfer of charge and dissipation of energy in the ionosphere–magnetosphere coupled system. (auth)

Magnetospheric Phenomena

Refer also to abstracts 7007, 7025, 7085, and 7088.

7094 (BUP-60) CORRELATED SATELLITE MEASUREMENTS OF PROTON PRECIPITATION AND PLASMA DENSITY. Soeraas, F.; Berg, L. E. (Bergen Univ. (Norway). Dept. of Physics). Mar 1974. 36p. Dep. NTIS (US Sales Only) $5.00.

The main experimental findings relating plasma densities in the equatorial plane (OGO5) to proton precipitation at high latitudes (ESRO IA), obtained from near simultaneous observations in the evening/midnight local time sector, can be summarized as follows: When the plasma density is high out to large L-values, most common during quiet geomagnetic conditions, the above 100 keV proton precipitation has no sharp equatorward boundary. The change from anisotropic pitch-angle distribution, peaked at 90° to the magnetic field lines, to isotropic is gradual with increasing L. When a sharp plasmapause is detected and the plasma densities outside the plasmapause are low there is a region outside the plasmapause where the proton flux is highly anisotropic. A rather abrupt transition to an isotropic pitch-angle distribution takes place approximately 1 Re outside the plasmapause. The higher energy protons reach their peak precipitation rate at L-values lower than the low-energy protons. An example where the precipitation pattern consists of two regions, in the auroral zone and at lower L-values, both occurring in regions with increased plasma density, is presented. The spatial and energy dependence of the proton precipitation pattern shows that the proton population is stable to precipitation losses in regions where the magnetic energy per particle exceeds the energy of the observed protons. In regions where the magnetic energy per particle is less than the energy of the protons, the protons can either precipitate with isotropic or anisotropic pitch-angle distribution. The on–off switch is controlled by the relation of particle energy to magnetic energy per particle, whereas the strength of the precipitation in the on-state is determined otherwise. Most aspects of these observations of precipitation protons and plasma density compare favorably with a theory that the cause of proton precipitation is ion-cyclotron instability. (auth)

7095 PLASMA INSTABILITIES IN THE MAGNETOSPHERE. Williams, D. J. (National Oceanic and Atmospheric Administration, Boulder, CO). pp 109-119 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

It is generally accepted that the dynamic processes in the magnetosphere are quite complicated and require detailed theoretical analyses and experimental observations to be identified and understood. However, given the appropriate measurements, which only recently have become available, even the complex field of plasma instabilities in the magnetosphere can be logically and successfully attacked. That it is becoming possible to identify and understand these dynamic plasma processes in the magnetosphere should provide encouragement in the difficult task of unravelling the dynamic processes occurring in the solar environment which are responsible for flares and their accompanying phenomena. (IAA)

7096 SUBSTORM PHENOMENA IN THE DISTANT MAGNETOSPHERE. Hones, E. W. Jr. (Los Alamos Scientific Lab., NM). pp 125-152 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

The substorm-related thinning and thickening of the magnetotail plasma sheet observed by the Vela satellites at a distance of about 18 R_e is described and illustrated by examples. Magnetic field measurements made by other satellites at approximately 30 and 60 R_e in the tail indicate that the plasma sheet at those greater distances undergoes the same type of substorm variations, approximately in coincidence with those at 18 R_e. These observations, together with plasma flow measurements made by the Vela satellites, support a substorm model for the plasma sheet in which the traditional substorm "breakup" features observed at the Earth signal the onset of magnetic field-line merging at some distance less than 15 R_e from the Earth, near the midnight sector of the tail. (auth)

7097 MAGNETOSPHERIC SUBSTORMS: A CRITICAL REVIEW. Akasofu, S. I. (Univ. of Alaska, Fairbanks). pp 153-166 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

An attempt is made to collate the great variety of new magnetospheric observations together with older observations within the framework of the concept of the magnetospheric substorm, and to consider a sequence of processes and their manifestations which might occur during a typical magnetospheric substorm. Magnetospheric substorm processes are described in terms of electrostatic fields which are internally induced in such a way that the electromotive force and the electrostatic fields together complete electric current circuits in the magnetosphere. It is generally thought that a magnetospheric substorm consists of a growth phase, an expansive phase, and a recovery phase. Observations of various phenomena during the different phases are reviewed. (IAA)

7098 SOURCES OF AURORAL ION PRECIPITATION. Whalen, B. A. (National Research Council, Ottawa). pp 167-200 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Observations of auroral-ion precipitation in the auroral zones are discussed, showing that the most likely sources of nightside auroral precipitation is the plasma sheet and that the plasma sheet is predominantly populated with ions of solar-wind origin. Dayside auroral-ion observations are also discussed and it is shown that the most probable source for these ions is the solar wind; however, the mode and point of entry of these particles into the magnetosphere is shown to be uncertain at this time. A new and unambiguous method of measuring convective electric fields by measuring the thermal ionospheric ion distribution function is discussed, and recently gathered data are presented which confirm the feasibility of the method. (IAA)

7099 CHARGE COMPOSITION ASPECT OF ENERGETIC TRAPPED PARTICLES. Krimigis, S. M. (Johns Hopkins Univ., Silver Spring, MD). pp 207-229 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Three possible sources of particle species important to the energy balance of the magnetosphere are discussed, with special emphasis on particles with different charge-to-mass ratios. Possibilities for various experimental tests are pointed out. Some recent experimental data on geomagnetically trapped alpha particles are compared with relevant results of current theoretical work. An experiment is proposed that is likely to provide quantitative indications for the energization and loss processes affecting ionic particle species in the magnetosphere. (IAA)

7100 FIELD-DETERMINED OSCILLATIONS IN THE MAGNETOSHEATH AS POSSIBLE SOURCE OF MEDIUM-PERIOD, DAYTIME MICROPULSATIONS. Greenstadt, E. W. (TRW Systems Group, Redondo Beach, CA). pp 515-547 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Studies of the magnetosheath show it to be characterized by the variable occurrence of large amplitude, sometimes quasi-periodic, field oscillations at diverse distances inward from the bow shock, including the region in proximity with the magnetopause. One established cause of such oscillations near the shock is local oblique orientation of the interplanetary field to the nominal shock surface, and there is evidence that the oscillations, or pulsations, composing the oblique structure appear also downstream in the sheath. It is suggested that medium-period micropulsations, exemplified by pc 3, might be excited in the magnetosphere when proper alignment of the interplanetary

field allows shock pulsations to be convected to the magnetopause by plasma flow through the subsolar section of the magnetosheath. (auth)

7101 DIFFICULTIES INVOLVED IN THE CORRELATION OF GROUND BASED OBSERVATIONS OF SUBSTORMS WITH SATELLITE DATA. Rostoker, G. (Univ. of Alberta, Edmonton). pp 549-567 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Magnetic variations in the deep magnetotail are considered, giving attention to studies by Camidge and Rostoker (1970) and Fairfield and Ness (1970). These studies have indicated that, associated with substorm activity, the tail field is reduced in magnitude. Near Earth the field becomes more dipolar. Magnetic variations at synchronous orbit are discussed along with magnetic variations at the Earth's surface and questions regarding the location of the region in which the ionospheric electrojet flows during substorms. (IAA)

7102 FIELD ALIGNED CURRENTS AND THE AURORAL SPECTRUM BELOW 1 keV. Arnoldy, R. L. (Univ. of New Hampshire, Durham). pp 571-597 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Measurements during auroral events were conducted with the aid of detectors flown aboard three Nike-Tomahawk rocket flights. The detectors used to measure the auroral spectrum below 1 keV consisted of electrostatic analyzers positioned in the rocket to measure particles moving up and down the magnetic field lines. The analyzers measured electrons and protons simultaneously during a given sweep. (IAA)

7103 CRITIQUE OF FLUID THEORY OF MAGNETOSPHERIC PHENOMENA. Heikkila, W. J. (Univ. of Texas, Dallas). pp 599-612 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

It is pointed out that the fluid theory has been successful in magnetospheric problems (such as the shape of the magnetopause) which involve basic considerations such as the conservation of particles, of momentum, and of energy, but that it is inadequate for other problems (such as the energization of auroral particles). Difficulties arise from the fact that it is not always possible to specify "a volume of plasma" because particles do not remain as neighbors. Misuse of the fluid theory has led to a number of fallacies, such as the idea that the causal order of physical events in cosmic electrodynamics is the reverse of that in the familiar laboratory electrodynamics. This mistaken idea comes from a confusion of a mathematical sequence of calculations with the causal order. A plea is made for a common sense approach to magnetospheric and auroral problems wherein the fluid theory is used whenever it can, but where it is not expected to be adequate for all occasions. (auth)

7104 HEAVY IONS IN THE MAGNETOSPHERE. Sharp, R. D.; Johnson, R. G. (Lockheed Research Labs., Palo Alto, CA). pp 677-681 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

Unexpected large fluxes of ions with a mass-per-unit-charge of about 16 and an energy-per-unit-charge as high as 12 keV were discovered by Shelley et al. (1972) and Sharp et al. (1972). The heavy ions are of particular interest as evidence of a dramatic acceleration mechanism occurring in the ionosphere. (IAA)

7105 PRELIMINARY REPORT ON A COOPERATIVE MAGNETOSPHERIC STUDY. Rossberg, L. (Max-Planck-Institut fuer Aeronomie, Lindau, Ger.). pp 703-712 of Solar Terrestrial Relations. Calgary, Alberta; Univ. of Calgary (1973).

From proceedings of the international conference on solar terrestrial relations; Calgary, Alberta (28 Aug 1972).

A proposal was made to conduct a multisatellite study in order to obtain an improved temporal and spatial resolution of the dynamic features of the particle distribution in the auroral zone and the related parts of the magnetosphere. In accordance with this proposal, data from polar satellites and from satellites in the equatorial plane are considered. These data are supplemented by ground-based observations of magnetic field perturbations around the northern auroral zone. (IAA)

7106 QUANTITATIVE MODEL FOR THE POTENTIAL RESULTING FROM RECONNECTION WITH AN ARBITRARY INTERPLANETARY MAGNETIC FIELD. Gonzalez, W. D.; Mozer, F. S. (Univ. of California, Berkeley). J. Geophys. Res.; 79: No. 28, 4186-4194(1 Oct 1974).

A three-dimensional model is utilized to derive the electric potential induced across the magnetosphere by reconnection between the geomagnetic field and an arbitrary interplanetary magnetic field. Assumptions that the magnetosheath flow is uniform and that reconnection is not limited by processes occurring at the magnetopause are made so that the model calculation provides an upper limit to the magnetospheric potential produced by reconnection. The magnitude of the polar cap ionospheric electric field computed from this model is larger than that measured on balloons by an average factor of about 3, and the model reproduces the temporal variations of the experimental data. Some magnetospheric properties related to the magnetopause reconnection line and potential are discussed as a first suggestion toward using the model in studies of relevant magnetospheric problems. The model potential induced across the magnetosphere becomes less dependent on the direction of the interplanetary magnetic field as the strength of its transverse component increases. Thus a reduced correlation between magnetospheric phenomena and the southward component of the interplanetary field should exist when the transverse interplanetary field component exceeds about 8 γ. Observed dependences of the polar cap ionospheric current system on B_Y are explained by the model, and similar variations with B_x are predicted. Graphs of the model potential as functions of the interplanetary magnetic field components are given as an aid in its application to other problems. (auth)

7107 MIDDAY Pc 1-2 PULSATIONS OBSERVED AT A SUBCLEFT LOCATION. Heacock, R. R. (Univ. of Alaska, Fairbanks). J. Geophys. Res.; 79: No. 28, 4239-4245(1 Oct 1974).

A class of unstructured Pc 1-2 pulsation activity, as identified on Bar I (70.2°N) records taken during 1968-1972, is found to be present in midday hours on about half of the days in summer months. The events have some tendency to occur in the later part of the ring current recovery phase, especially at times of moderate AE when the cleft lines are just poleward of Bar I. The source lines of the Pc 1-2 are found to lie essentially outside the plasmapause. In terms of the proton cyclotron resonance instability the most likely source regions of the Bar I Pc 1-2 are the detached plasma regions convecting sunward on the day side and the portion of the cleft plasma on the last closed field lines. (auth)

7108 MAGNETOPAUSE ROTATIONAL FORMS. Sonnerup, B. U. O. (Dartmouth Coll., Hanover, NH); Ledley, B. G. J. Geophys. Res.; 79: No. 28, 4309-4314(1 Oct 1974).

Magnetic field data from the Goddard Space Flight Center magnetometer experiment on board Ogo 5 were analyzed by the minimum variance technique for two magnetopause crossings, believed to provide the best evidence presently available of magnetopause rotational discontinuities. Approximate agreement with predictions from MHD and first-order orbit theory was found, but available low-energy electron data suggest the presence of significant non-MHD effects. The paper also illustrates an improved method for data interval selection, a new magnetopause hodogram representation, and the utility of data simulation. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Beams and Their Reactions

Refer also to abstracts 6276, 7429, 7437, and 7443.

7109 (COO-3243-3, pp 46-55) MOLECULAR ION BEAM EXPERIMENT. Colvett, R. D.; Rohrig, N.; Gross, W.; Rossi, H. H. 1 Jul 1974.

In annual report on research project.

The apparatus in which a beam of charged molecules is incident on a Mylar film supporting attached cells is described. The irradiation sequence and measurements multiple Coulomb scattering are also briefly discussed. (CES)

7110 (ORNL-4979, pp 177) THEORETICAL RADIATION PHYSICS: X-RAY EXCITATION OF SURFACE PLASMONS ON SPHERES AND CYLINDERS. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The calculation of surface-plasmon excitation in x-ray inelastic scattering on spherical particles is outlined. (CES)

7111 ION EMISSION REGULATOR FOR THE SURFACE IONIZATION ION SOURCE. Kita, S.; Niurao, K.; Inouye, H. (Tohoku Univ., Sendai). Shitsuryo Bunseki; 21: No. 4, 263-270 (Dec 1973). (In Japanese).

A simple ion emission regulator is described for a surface ionization ion source in the current range of 10^{-7} to 10^{-9}A. The principle of regulation is quite similar to that of an electron emission regulation for an ionization vacuum gauge, except that the regulator has a simple electrometer circuit. The stability is about 1% after running of 1 hour, if a stabilized ac power supply is used. The regulator was successfully employed in an ion beam experiment using hydrogen as a target gas. (auth)

7112 LOW-ENERGY ELECTRON GUN SYSTEM. Shinohara, K. (to Matsushita Electric Industrial Co. Ltd.). Japanese Patent 1973,12518. 22 Dec 1969. 3p. (In Japanese).

A conventional electron gun consists of an elongated filament and an elongated reflector electrode which accelerates the electrons from the cathode filament. In such an electron gun system, the deformation of the filament wire affects the focusing performance of the system. The purpose of the present invention is to provide an electron gun system in which the readjustment of the focusing system is greatly facilitated compared to that of the conventional systems. The reflecting electrode is divided into several sections in the longitudinal direction, so that the potential of each electrode can be independently varied. Several monitor electrodes are provided corresponding to each of the reflector sections, and the point where the electron beam intersects the radiating window is monitored by the electrodes. When the electron beam is defocused in a given section, readjustment of the reflector potential may be controlled to compensate for filament deformation. (JA)

7113 ELECTRON GUN SYSTEM. Shinohara, K. (to Matsushita Electric Industrial Co. Ltd.). Japanese Patent 1973,12520. 24 Dec 1969. 3p. (In Japanese).

In a low energy electron gun of high irradiation efficiency which provides electron beam of about 150 keV, the life duration of the cathode filament is limited very short, since a large amount of electron beam current is extracted from the filament. The present invention is to greatly prolong the lifetime of the filament in order to avoid the interruption of gun operation during the replacement of the filament. The apparatus comprises a long filament, a storing box to store the spare filament, a withdrawing box to store the used part of the filament, and two clamp means to hold the filament in place, one of which is movable in the direction parallel to the filament line. A long linear filament (100 meters long) is stored in the storing box, and the filament runs across the space between the storing and withdrawing boxes. Two clamp means are provided to hold the filament in a predetermined position just under the reflector electrode. Thus, the filament is advanced from the storing box to the withdrawing box for one unit length at a time by means of the movable clamp mean in advance of snapping of the filament. In this way, a filament of a thousand meters long can provide three hundred thousand hours (nearly thirty years) of life if it is advanced one meter every three hundred hours. (JA)

7114 ION EMISSION REGULATOR FOR THE SURFACE IONIZATION ION SOURCE. Kita, Shigetomo; Niurao, Kenichi; Inouye, Hokotomo (Tohoku Univ., Sendai (Japan). Research Inst. for Scientific Measurements). Shitsuryo Bunseki; 21: No. 4, 263-270(Dec 1973). (In Japanese).

A simple ion emission regulator is described for a surface ionization ion source in the current range of 10^{-7}-10^{-9}A. The principle of regulation is quite similar to that of an electron emission regulation for an ionization vacuum gauge, except that the regulator has a simple electrometer circuit. The stability is about 1% after running of 1 hour, if a stabilized a.c. power supply is used. The regulator was successfully employed in an ion beam experiment using hydrogen as a target gas. (auth)

7115 THERMIONIC SOURCE OF ALKALI METALS IN A PIERCE GUN. Chigin, V. I. (Lvov State Univ.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 2, 492-494(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 2, 165-166(1974).

A method is described for fabricating thermionic emitters having a stipulated surface shape, which is required for normal operation of a Pierce gun for shaping of beams of alkali-metal ions having low energies. Overall currents of ~10^{-5}-10^{-6} A were obtained at accelerating voltages of 20 to 30 V. (auth)

7116 SOURCE OF NEGATIVE IONS FOR VAPOR SUBSTANCES. Paleev, V. I.; Zandberg, E. Ya. (Physical-Technical Inst., Leningrad). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 2, 489-491(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 2, 163-164(1974).

An ion source is described based on secondary ion-ion emission, which is designed for obtaining negative ions of gas and vapor substances. Negative ions are formed in it by using positive ions to bombard the target on which the gas or vapor molecules introduced into the chamber of the ion source are continuously adsorbed. The positive ions required to knock out the negative ions are created in the same ion-source chamber by ionizing the vapor or gas by means of electrons. (auth)

7117 BEAM CONTROL IN A MARTIN-TYPE ELECTRON GUN. Roetzer, G.; Franco, J. (Universidad de Oriente, Cumana, Venezuela). J. Phys., E (London); 7: No. 11, 880-881(Nov 1974).

A simple model for the gun structure, together with the resultant improvements in gun operation, are given. (auth)

7118 MEASUREMENT OF THE ADHESION AND ISOTHERMAL DESORPTION COEFFICIENTS OF THE CARBON OXIDE MOLECULES ON THE Sc, Ti, V AND Cr FILMS BY MOLECULAR BEAM METHOD. Bosov, V. S.; Vinogradov, M. I. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 2, 265-272(Feb 1974). (In Russian).

For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The interaction of CO molecules with condensed films of Sc, Ti, V, and Cr was studied in the temperature interval from 78 to 900°K by the molecular beam method. The increase of the stability of the chemisorbed complexes Me–C≡O in the sequence from Sc to Cr was explained by use of the molecular-orbital representation. (tr-auth)

7119 POSITIVE SURFACE IONIZATION OF THE KCl MOLECULES ON THE (100) FACE OF MOLYBDENUM. Chajkovskij, Eh. F.; Pyatigorskij, G. M.; Derkach, Yu. F. Izv. Akad. Nauk SSSR, Ser. Fiz.; 38: No. 2, 376-380(Feb 1974). (In Russian).

For English translation see the journal Bull. Acad. Sci. USSR, Phys. Sci.

The surface ionization of the KCl–Mo(100) system was investigated. In the calculation of the surface ionization data on the rate of desorption of halogen atoms from the (100) face of Mo can be used satisfactorily. The dependence of the logarithm of the ion current of the alkali metal on the inverse temperature of the emitter at constant density of the bombarding molecule current was established. (tr-auth)

7120 SOURCE OF A BEAM OF HYDROGEN ATOMS. Izrailov, E. K. (Scientific-Research Inst. of Metrology, Leningrad). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 655-657 (1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 28-30(1974).

A thermal source is described which serves to obtain a beam of hydrogen atoms in the ground state ($1^2S_{1/2}$). The beam was used to determine the fine-structure constant α. The main section of the source is an oven which can be moved in a vacuum and contains a tungsten tube and tungsten bushings. The collimated beam of atoms was indicated by markers (spots) which were left on a metallic plate that was vacuum deposited by molybdenum oxide. The source operated successfully at a temperature of 2800°K and a hydrogen pressure of ~0.3 torr in the oven; the association amounted to about 95%. (auth)

7121 OBTAINING BEAMS OF NEGATIVE HYDROGEN AND HELIUM IONS BY THE METHOD OF CHARGE EXCHANGE IN SODIUM VAPORS. Dimov, G. I.; Roslyakov, G. V. (Inst. of Nuclear Physics, Novosibirsk, USSR). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 17: No. 3, 658-662(1974).

Translated from Prib. Tekh. Eksp.; 17: No. 3, 31-35(1974).

The results of experiments on obtaining pulsed beams of negative hydrogen and helium ions by charge exchange of H^+, D^+, and He^+ ions in sodium vapors are described. The construction and principal characteristics of a pulsed sodium target are presented. Ion currents of 76 mA for H^-, 104 mA for D^-, and 10.5 mA for He^- in a pulse having a length of 100 μsec were obtained. (auth)

Atomic and Molecular Properties

Refer also to abstracts 6727 and 7400.

7122 (AD-781766) BROADENING OF SPECTRAL LINES OF UNHYDROGENLIKE IONS. Alekseev, V. A.; Yukov, E. A. Translated by B. Kingsley and V. Vaguine from Tr. Fiz. Inst., Akad. Nauk SSSR; 51: 74-78(1970). 9p. (FSTC-HT-23-1201-73). NTIS $4.00.

Spectral line widths for Ar(II) are calculated, taking into account the effect of the perturbing electron trajectory distortion. This consideration resulted in an approximately two-fold increase in the line widths and is in good agreement with experimental data. (auth)

7123 (ORNL-4979, pp 226-229) ATOMIC PHYSICS: JESSE EFFECT IN HELIUM. Hurst, G. S.; Garrett, W. R.; Judish, J. P.; Klots, C. E.; McNeely, J. R.; Payne, M. G.; Wagner, E. B. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

An origin is suggested for the linear pressure terms, and several suggestions are provided about the detailed energy pathways and the origin of the Jesse effects in helium excited by fast charged particles. Suggestions concerning mechanisms determining the time dependence of the continuum radiation are also made. (JFP)

7124 (UCID-16011) VALUES OF K- AND L-SHELL ENERGIES AND EFFICIENCIES IN CROSS SECTION FILE, CSLIB11/71. Harper, T. L.; McMaster, W. H. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Mar 1972. Contract W-7405-eng-48. 31p. Dep. NTIS $4.75.

A list is given, by atomic number, of the K- and L-shell energy values and fluorescent line efficiency values that are presently sorted in the x-ray cross section file CSLIB11/71. (JFP)

7125 (UCRL-13606) BOLTZMANN AVERAGES OF THE FREE-FREE GAUNT FACTOR IN THE SCREENED COULOMB POTENTIAL. Green, J. M. (R and D Associates, Santa Monica, Calif. (USA)). Aug 1974. 63p. (RDA-TR-4900-007). Dep. NTIS $2.25.

For Univ. of California, Livermore.

Tables and figures are presented for the Boltzmann averages of the free-free gaunt factor in the screened Coulomb potential. (JFP)

7126 NEGATIVE ION EXCITED STATES AND DETERMINATION OF THEIR ENERGY BY ELECTRON DETACHMENT BY AN ELECTRIC FIELD. Oparin, V. A.; Il'in, R. N.; Serenkov, I. T.; Solov'ev, E. S. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksp. Teor. Fiz.; 66: No. 6, 2008-2019(Jun 1974). (In Russian).

Detachment of electrons from negative ions under the action of an external electric field $E \leq 450$ kV/cm is investigated. It is shown that excited metastable states with a binding energy $\epsilon < 0.2$ eV exist in the following ions: $He^-(^4P)$, $C^-(^2D)$, $Si^-(^2P)$, $Al^-(^1D)$. The binding energies of the states are determined on basis of their rate of decay in a field E. For $He^-(1s2s2p^4P)$ the energy is (0.075 ± 0.005) eV, for $C^-(^2D)$ it is (0.037 ± 0.003) eV, for $Si^-(^2P)$ – (0.035 ± 0.004) eV and for $Al^-(^1D)$ – 0.095 eV. The binding energy for the $Al^-(^3P)$ ground state (electron affinity energy) is estimated to be ≥0.2 eV. (auth)

7127 SOME PARITY NONCONSERVATION EFFECTS IN RADIATION BY HYDROGEN-LIKE ATOMS. Azimov, Ya. I.; Ansel'm, A. A.; Moskalev, A. N.; Ryndin, R. M. (Leningrad Inst. of Nuclear Physics). Zh. Eksp. Teor. Fiz.; 67: No. 1, 17-29 (Jul 1974). (In Russian).

Some effects of nonconservation of P-parity in electromagnetic radiation by hydrogen-like atoms under the $2S_{\frac{1}{2}} \rightarrow 1S_{\frac{1}{2}}$ transition in the presence of an external magnetic field are considered. The effects are due to weak interaction between neutral electron and proton currents which violate parity. Zeeman splitting and the atomic level shift in a magnetic field permit the degree of circular polarization of photons to be increased by approximately five times (for H~1 kG) compared to the value in the absence of the field. Another P-odd correlation, viz. anisotropy of photon emission with respect to the magnetic field direction, may also be observed in an external magnetic field. In principle, a study of the dependence of P-odd correlations on magnetic field strength permits one to determine the form of the weak electron-proton interaction. The effect of external electromagnetic fields on the $2S_{\frac{1}{2}} \rightarrow 1S_{\frac{1}{2}}$ transition is also considered. Restrictions are found on the random fields for which observation of the parity nonconservation effects can be observed: $D < 10^{-5}$ V/cm, $H < 10^{-1}$ G (in the absence of a strong external magnetic field) or $D < 10^{-3}$ V/cm (in an external field H~1 kG). (auth)

7128 PARAMETRIC RELAXATION RESONANCE OF OPTICALLY ORIENTED METASTABLE ^{4}He ATOMS IN AN EFFECTIVE MAGNETIC FIELD. Okunevich, A. I. (Ioffe Physical-Technical Inst., Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 3, 881-889(Sep 1974). (In Russian).

Experiments are performed with modulation of discharge intensity on optical orientation of metastable ^{4}He atoms under magnetic resonance conditions. It is found that relaxation modulation which appears in this case results in resonant variation of absorption of the pumping light when the nutation frequency ω_1 is equal to the modulation frequency and also when $\omega_1 = 0$. The resonance signals observed are identified as the relaxation resonance signals previously predicted. A detailed comparison of properties of the signals observed with the theory is carried out. (auth)

7129 MULTIPHOTON TRANSITIONS IN A HYDROGEN-LIKE ATOM. Oleinik, V. P.; Chumachkova, M. M. (Inst. of Semiconductors, Kiev). Zh. Eksp. Teor. Fiz.; 67: No. 3, 926-929 (Sep 1974). (In Russian).

A formula is derived and investigated for the probability of a multiphoton transition of a hydrogen-like atom from the ground state to the first excited state induced by an electromagnetic field. The latter consists of an intense electromagnetic wave of frequency $\omega_1 \ll (\epsilon_1 - \epsilon_0)/\hbar$ and weak electromagnetic radiation of frequencies $\omega_2 \sim (\epsilon_1 - \epsilon_0)/\hbar$ (ϵ_0 and ϵ_1 are the energies of the atomic ground state and first excited state). (auth)

7130 A PRIORI CALCULATION OF COLLISIONAL POLARIZABILITIES: $(He)_2$, $(Ne)_2$, AND $(Ar)_2$. Harris, R. A.; Heller, D. F.; Gelbart, W. M. (Univ. of California, Berkeley). J. Chem. Phys.; 61: No. 9, 3854-3855(1 Nov 1974).

A priori theoretical values are reported for the pair polarizabilities of He_2, Ne_2, and Ar_2 as obtained from an electron gas approximation. The results include the first correct prediction of the sign and magnitude of the leading density dependent correction to the neon dielectric function and accurate Kerr electric field-induced birefringence coefficients and light scattering depolarization ratios for the light noble gases. (JFP)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

7131 INFLUENCE OF ELECTROLYTES ON μ^+-MESON DEPOLARIZATION. Minaichev, E. V.; Myasishcheva, G. G.; Obukhov, Yu. V.; Roganov, V. S.; Savel'ev, G. I.; Smilga, V. P.; Firsov, V. G. Zh. Eksp. Teor. Fiz.; 66: No. 6, 1926-1932(Jun 1974). (In Russian).

The dependence of μ-e decay polarization in solutions of various strong electrolytes on concentration of the latter is measured. The data are interpreted within the framework of the theory of muonium depolarization for μ^+-mesons in a medium. The mechanisms of the processes are discussed and the rate constants for interaction between muonium and a number of various ions are determined. (auth)

7132 ORBITAL CAPTURE OF K^--MESONS AND Σ^--HYPERONS IN LIQUID HELIUM. Comber, C. (University Coll., London); Davis, D. H.; Gordon, J.; Tovee, D. N.; Roosen, R.; Velde-Wilquet, C. V.; Wickens, J. H. Nuovo Cim., A; 24A: No. 3, 294-300(1 Dec 1974).

The mean cascade times of both K^--mesons and Σ^--hyperons in their captures at rest in liquid helium were determined to be $(3,1 \pm 0,4) \cdot 10^{-10}$ s and less than $3,6 \cdot 10^{-11}$ s (with a confidence level of 90%) respectively. The finding of a much lower mean cascade time for Σ^--hyperons than for K^--mesons lends weight to the hypothesis of trapping of negative hadrons in metastable orbits in helium. (auth)

7133 THEORY OF RADIATIONLESS TRANSITIONS IN MESOATOMS. Zaretskii, D. F.; Lyul'ka, V. A. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 20: No. 4, 726-730(Oct 1974). (In Russian).

Process of radiationless transitions in heavy mesoatoms, due to the transfer of the meson excitation energy to the nucleus, is considered. Cases of overlapping as well as of nonoverlapping levels of the compound nucleus are studied. Probabilities of the radiationless nuclear excitation are calculated for various relations between the radiative and radiationless widths. (auth)

Collision Phenomena

Refer also to abstracts 6256 and 7446.

7134 (AD-775734) THEORETICAL FOUNDATION FOR A GENERAL QUANTAL MOLECULAR REACTION RATE CODE. Volume I. General Formulation and Review of Vibrational Relaxation Theories and Measurements. Final Report, 22 May-9 December 1973. Ormondo, S. (Quantum Systems, Inc., Albuquerque, N. Mex. (USA)). Feb 1974. 128p. NTIS $4.75.

The research examined the possible foundations for the development of a general molecular reaction rate code for use in laser modeling work. A survey is given of some experimental and theoretical results, familiarity with which, it was felt, would be of value in defining the physical and computational elements to be incorporated in an ab initio modeling code. The survey was contained somewhat by restricting it to articles concerned with reactions involving energy transfer processes in gases most frequently used in chemical lasers based on the halides. The basic data base consisting of measurements of molecular relaxation rates and theories ranging from semiempirical to quantal with illustrative examples is reviewed and summarized. (auth)

7135 (ANU-P-596) EQUILIBRIUM CHARGE STATE DISTRIBUTIONS OF HEAVY IONS IN CARBON. Ferguson, S. M. (Australian National Univ., Canberra. Dept. of Nuclear Physics). Jun 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

Graphs are given of the equilibrium charge state distributions of several heavy ions after passing through carbon foils. It should be useful to tandem Van de Graaff operators and to operators planning magnetic spectrometers experiments. Data are given for the following ions: carbon, nitrogen, fluorine, chlorine, oxygen, sulfur, bromine, tantalum and uranium. (AT)

7136 (ORNL-4979, pp 111-124) ELECTRON AND ION COLLISION PHYSICS. Compton, R. N.; Anderson, V. E.; Carter, A. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The topics discussed include molecular electron affinities in collisional ionization of cesium by molecules, cesium collisions with CO_2, cesium collisions with some octahedral hexafluoride molecules, electron attachment and cesium collisional ionization studies of organic molecules, dissociation and autoionization lifetimes, energy pathways in the rare gases, dissociative ionization of molecules by electron impact, dissociative ionization of D_2 and N_2, predissociation of the $B^2\xi_g^-$ state of O_2^+, mass analysis of negative ions produced in swarm experiments of ion clustering in ammonia, and low energy electron-induced sputtering of alkali halides. (JFP)

7137 (ORNL-4979, pp 153-167) ATOMIC AND MOLECULAR RADIATION PHYSICS: ATTACHMENT OF SLOW (<1 eV) ELECTRONS TO O_2 IN VERY HIGH PRESSURES OF NITROGEN, ETHYLENE, AND ETHANE. Christophorou, L. G.; Abner, C. H.; Anderson, V. E. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The discussion of electron attachment covers the dependence of the attachment rate on the density and the nature of the medium. Electron capture mechanisms and reaction schemes consistent with the observed dependences of the attachment rates on the density of each medium were developed. (JFP)

7138 (ORNL-4979, pp 174-176) THEORETICAL RADIATION PHYSICS: MOLECULAR SCATTERING. Convergence of Close-Coupling Expansions in the Presence of Many Open Channels. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

In low-energy atomic scattering theory, the accuracy of the familiar target-eigenstate-expansion or "close-coupling" methods cannot be relied upon unless all open channels of the target system are included in the expansion. It is shown that the same methods, as applied to low-energy scattering by a molecular target, converge even though all open channels above a certain energy level may be truncated in the target eigenstate expansion. (CES)

7139 (ORNL-4979, pp 229-230) ATOMIC PHYSICS: ENERGY TRANSFER FROM THE RESONANCE STATES $Ar(^1P_1)$ AND $Ar(^3P_1)$ TO ETHYLENE. Hurst, G. S.; Garrett, W. R.; Judish, J. P.; Klots, C. E.; McNeely, J. R.; Payne, M. G.; Wagner, E. B. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Energy transfer is studied experimentally for the $^1P_1$(1048 Å) and the $^3P_1$ (1067 Å) states of argon and compared with previous energy transfer theory. The rate constants are discussed. (JFP)

7140 (ORNL-4979, pp 230) ATOMIC PHYSICS: ENERGY TRANSFER FROM THE RESONANCE STATES $Ar(^1P_1)$ AND $Ar(^3P_1)$ TO NITROGEN. Hurst, G. S.; Garrett, W. R.; Judish, J. P.; Klots, C. E.; McNeely, J. R.; Payne, M. G.; Wagner, E. B. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Rate constants and average cross sections for the discrete-discrete transfer of electronic energy from argon resonance states $Ar(^1P_1)$ and $Ar(^3P_1)$ to the nitrogen molecule N_2 were measured using the time-resolved quenching technique. (JFP)

7141 RESONANT CHARGE EXCHANGE OF ALKALI EARTH IONS. Panev, G. S.; Zavilopulo, A. N.; Zapesochnyi, I. P.; Shpenik, O. B. (Uzhgorod State Univ., USSR). Zh. Eksp. Teor. Fiz.; 67: No. 1, 47-53(Jul 1974). (In Russian).

The total cross sections for resonant charge exchange of Hg^+, Ca^+, Sr^+ and Ba^+ ions are investigated experimentally in the 6 to 1000 eV energy range. The measurements are performed by the intersecting ion and atomic beam technique in which a new method of extracting and recording the slow charge exchange ions is used. As a whole the resonant charge exchange cross sections increase monotonically with decrease of interaction energy and at an energy of 6 eV attains the values of 1.5 (10^{-14}), 2.2(10^{-14}), 2.7(10^{-14}) and 3.9(10^{-14}) cm^2 for Mg^+, Ca^+, Sr^+, and Ba^+ respectively. Regular oscillations with frequencies 1.57(10^8), 1.57(10^8) and 0.86(10^8) cm/s are observed for the Ca^+ + Ca, Sr^+ + Sr and Ba^+ + Ba processes respectively. The results are compared with calculations performed on basis of the Smirnov, Firsov and Rapp-Francis formulas. It is suggested that the oscillations are due to the contribution of inelastic transitions to the total cross section. (auth)

7142 APPLICATION OF ZERO RANGE POTENTIALS IN THE THEORY OF COLLISIONS OF ELECTRONS WITH MOLECULES. Drukarev, G. F. (Leningrad State Univ.). Zh. Eksp. Teor. Fiz.; 67: No. 1, 38-46(Jul 1974). (In Russian).

The interaction between a light particle 1 and a bound system consisting of two heavy particles (2,3) ($m_1 \ll m_{23}$) is considered under the assumption that the energy of particle 1 appreciably exceeds the binding energy of system (2,3) and that the attraction of 1 to 2 and 3 can be replaced by a zero range potential. An approximate solution of the Faddeev equations is obtained, and on its basis expressions are derived for the effective cross sections for elastic and inelastic collisions and for the rearrangement process 1 + (2, 3) → (1, 2) + 3. It is suggested that the expressions obtained may be used for calculating the excitation of rotation and oscillations of molecules by electron impact and also the process of dissociative attachment at electron energies of several eV. (auth)

7143 SEMICLASSICAL TREATMENT OF BOUND STATE SYSTEMS. III. A Uniform Stationary Phase Integration for the Multidimensional Problem. Starkschall, G.; Light, J. C. (Univ. of Chicago). J. Chem. Phys.; 61: No. 8, 3417-3421(15 Oct 1974).

The semiclassical bound state formalism is extended to the multidimensional problem by deriving an expression for the reduced density matrix which remains finite when the charge density is calculated. A uniform stationary phase integration technique is derived by mapping the phase of the semiclassical propagator onto a function which has the same behavior as the phase of the free particle propagator, enabling one to incorporate the singularity at t = 0 into the integration. The resulting rdm has the oscillatory behavior of a Bessel function of order d/2, where d is the dimensionality, rather than that of a simple trigonometric function. (auth)

7144 ENERGY DEPENDENCE OF THE BRANCHING FRACTION AND CROSS SECTIONS FOR THE DECAY OF COLLISION COMPLEXES: K + CsF, RbF. Stolte, S.; Proctor, A. E.; Bernstein, R. B. (Univ. of Wisconsin, Madison). J. Chem. Phys.; 61: No. 9, 3855-3856(1 Nov 1974).

The reactions CsF + K → KF + Cs and RbF + K → KF + Rb were studied in crossed beams. A strongly different reactivity behavior was observed, attributable mainly to the difference in sign of the exothermicity. Angular distributions are discussed. Log-log plots of the branching fractions and cross sections versus translational energy are shown. (JFP)

7145 HIGHER-ORDER LONG-RANGE INTERACTIONS BETWEEN RARE GAS AND HYDROGEN ATOMS. Stwalley,

W. C. (Univ. of Iowa, Iowa City). J. Chem. Phys.; 61: No. 9, 3840-3841(1 Nov 1974).

Theoretical values for the multipole polarizabilities and like atom van der Waals coefficients C_8, C_8, and C_{10} are used with the Kramer–Herschbach combination rules to calculate C_8 and C_{10} for unlike atoms in the set (H, He, Ne, Ar, Kr, Xe). It is argued that in most cases these values are the most accurate available and should be good to ~±10%. (auth)

7146 SEMICLASSICAL THREE-DIMENSIONAL INELASTIC SCATTERING THEORY. Sorensen, G. B. (Univ. of Copenhagen). J. Chem. Phys.; 61: No. 8, 3340-3343(15 Oct 1974).

A semiclassical theory, which does not involve the use of complex trajectories or multidimensional root-searching, is presented. For a linearly forced harmonic oscillator the number of coupled equations to be solved is halved. The rotation–vibration coupling term is discussed and taken into account. (auth)

7147 PRODUCTION OF EXCITED METAL IONS IN THERMAL ENERGY CHARGE TRANSFER AND PENNING REACTIONS. Green, J. M.; Webb, C. E. (Oxford Univ.). J. Phys., B (London); 7: No. 13, 1698-1711(11 Sep 1974).

Some characteristics of thermal energy charge transfer and Penning reactions with excited state products are deduced from flowing afterglow studies of several such reactions. Relative excitation cross sections for individual excited states accessible to these reactions have been measured for the first time. New metal ion laser systems, some offering the prospect of CW laser action in the near ultraviolet, are proposed. Difficulties encountered in formulating theoretical predictions of the cross section for charge transfer into excited states are also discussed. (auth)

7148 SEMICLASSICAL THEORY OF VIBRATIONALLY INELASTIC SCATTERING, WITH APPLICATION TO $H^+ + H_2$. Collins, F. S. New Haven; Yale Univ. (1974). 266p. University Microfilms Order No. 74-25,727.

Thesis (Ph. D.).

Molecular inelastic scattering contributes directly to a variety of important physical processes. However, the quantum theory of inelastic collisions is usually insoluble, and it is essential to develop certain simplifying approximations. A semiclassical approach meets this demand nicely by employing a WKB approach for the translational motion. This method encounters difficulties, however, in the region of the classical turning point where the simple WKB functions are invalid. A possible correction method is derived which should go a long way towards alleviating this difficulty. Until very recently, a detailed comparison between theory and experiment in the area of vibrationally inelastic scattering has not been possible. However, experimental data on $H^+ + H_2$ has now appeared, and the interaction potential is well known. Ab initio semiclassical calculations of total and differential cross sections for $H^+ + H_2$ at energies from 10 eV to 1000 eV c.m. are presented and found to agree well with experiment. In addition, a number of approximations which greatly reduce the computational effort are developed and tested. (Diss. Abstr. Int., B)

7149 SOME TECHNIQUES FOR TREATING RESONANCES IN ATOMIC COLLISIONS. Bain, R. A. Austin, TX; Univ. of Texas (1974). 133p. University Microfilms Order No. 74-24,826.

Thesis (Ph. D.).

New methods for treating shape and closed channel resonances are developed and applied to model problems and real atomic systems. A quantum technique for the calculation of the position and width of shape resonances is described. The approach, based upon mathematical properties of solutions to Schroedinger's equation, appears to be the only purely quantal method applicable to resonances with very long lifetimes. Results for a Lennard-Jones potential are presented and compared with previous quantum and semi-classical calculations. Potential barriers in atomic interactions often lead to shape resonances in which the particles are held together for substantial times by the barrier. The extra duration of such a collision could have significant effects on the reaction rates of thermal collision processes. The importance of these resonances in radiative association and three-body recombination is assessed by means of an inequality relating the resonant and nonresonant contributions to the total reaction rate. Numerical results for radiative association in CH indicate that the presence of a potential barrier enhances the total reaction rate. Three-body recombination in argon dimers is also investigated. Results demonstrate that contributions from the resonance mechanism are insignificant. It is argued that resonant contributions to such atomic collision processes are important only in strongly bound systems. The complex coordinate rotation method of Nuttall is investigated. A potential scattering problem is utilized to examine alternative methods for choosing a basis set for use in a configuration-interaction calculation. The types of trial functions which appear to be viable are used to compute the lowest s-wave resonance in the e-H and e-He scattering systems. Results are compared with existing experimental and theoretical investigations. For the He-(^{2}S) resonance, present calculations tend to substantiate results of several experiments. It is believed that the present results resolve the disagreement that exists between these experiments and the previous theoretical treatment. (Diss. Abstr. Int., B)

7150 DELAYED COINCIDENCE STUDIES OF ELECTRON IMPACT EXCITATION OF THE $C^3\Pi_u$, $D^3\Sigma_u^+$, AND $E^3\Sigma_g^+$ STATES OF NITROGEN. Egbert, G. T. Lincoln, NE; Univ. of Nebraska (1974). University Microfilms Order No. 74-23,890.

Thesis (Ph. D.).

Electrons emitted from a hot cathode were accelerated and focused by a multistage electron gun and allowed to collide with a static molecular nitrogen gas target. Following excitation the photons emitted by the nitrogen molecules were observed at 90° to the beam direction. Using the technique of delayed coincidence emissions from the (0,0) band of the second positive system ($C^3\Pi_u \rightarrow B^3\Pi_g$) at 3371 Å were separated into prompt and delayed components. Prompt emissions were those which resulted from molecules initially excited to the $C^3\Pi_u$ state which in turn decayed to the $B^3\Pi$ state. Delayed emissions were those which resulted from molecules initially excited to the $E^3\Sigma_g^+$ state which then were collisionally deactivated to the $C^3\Pi_u$ state before decaying to the B state. Both the prompt and delayed contributions to the total emission were measured for incident electron energies in the range 10 to 40 eV. Plots of these contributions as a function of electron-impact energy, referred to as emission functions, were recorded and compared to the theoretical and experimental results of others. In addition, lifetime measurements made on these emissions, at various energies, provided further information concerning structure observed in the delayed emission function. The pressure dependence of the emissions is discussed. The lifetime of the (0,0) band of the fourth positive system ($D^3\Sigma_u^+ \rightarrow B^3\Pi_g$) at 2660 Å was measured also using the delayed coincidence technique. An emission function for this transition was recorded for incident electron energies in the range 10 to 50 eV. The present lifetime measurement was the first reported value which has been verified. The emission function was compared to the theoretical and experimental results of the other researchers. The present system was modified, with the addition of a parallel plate analyzer, to a full coincidence experiment. Initial results from this experiment are also presented. (Diss. Abstr. Int., B)

Atomic Theory

Refer also to abstract 7125.

7151 STATIONARY ATOMIC STATES IN A QUANTIZED ELECTROMAGNETIC FIELD. Yakovlev, V. P. (Moscow Engineering-Physics Inst.). Zh. Eksp. Teor. Fiz.; 67: No. 3, 921-925(Sep 1974). (In Russian).

The interaction between a two-level atom and a quantized electromagnetic field whose frequency is great compared to the distance between the levels is investigated. The energy spectrum and eigenstates of the system are obtained for an arbitrary intensity field. Transition to the quasiclassical case is considered. The problem of oscillations of intensity of spontaneous radiation as a function of field amplitude is discussed. (auth)

7152 WHAT IS THE BEST EXPRESSION OF THE SECOND-ORDER SUM-OVER-STATE PERTURBATION ENERGY BASED ON THE HARTREE–FOCK WAVEFUNCTION. Nakatsuji, H. (Yeshiva Univ., New York). J. Chem. Phys.; 61: No. 9, 3728-3736(1 Nov 1974).

The second-order sum-over-state perturbation energy which is written in the infinite sum over singly excited configurations based on the Hartree–Fock (HF) zeroth-order wave function is improved in a stepwise manner. Firstly, the conventional equation is shown to be dependent on the unitary transformations among singly excited configurations. The best unitary transformation gives the Tamm–Dancoff (or singly excited configuration interaction) approximation of the excited states. The resultant equation includes in a simple form all of the coupling terms between different singly excited configurations. As a restrictive special case, this unitary transformation leads to the modified HF orbitals of Silverstone–Huzinaga and Morokuma–Iwata. Secondly, it is shown that the second-order energy of the coupled HF theory can also be written in a simple sum-over-state perturbation formula. The resultant equation does not require an iterative solution. Moreover, it is shown that this is the best possible expression of the second-order energy based on the HF zeroth-order wave function. As a restrictive special case, this treatment produces new improved modified HF operators which are thought to be superior to those hitherto given. (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

7153 VISCOUS MFD LOW HARTMANN FLOW IN AN ANNULAR GAP: A MAGNETIC PRANDTL NUMBER EXPANSION. Matalon, M.; Schweitzer, S. (Tel Aviv Univ., Israel). J. Franklin Inst.; 297: No. 4, 259-285(Apr 1974).

The problem of a liquid conductor confined between two concentric cylindrical electrodes and driven electromagnetically is considered. The steady, three-dimensional viscous case is treated asymptotically in the limit of small magnetic Prandtl numbers. The zeroth-order solution to the coupled hydrodynamic and Maxwell equations yields the trivial solution of no motion in the limit of vanishing conductivity. Results for the first-order solution indicate two-dimensional effects in the electromagnetic field quantities while the first-order velocity is one-dimensional in the circumferential direction. Due to secular effects the solution is limited to values of small Hartmann numbers. The formulation of the second order and a limited solution for the velocity distribution indicates that the velocity field is three-dimensional having a cell-type structure. (auth)

PHYSICS (HIGH-ENERGY)

Particle Interactions and Properties (Experimental)

7154 (COO-2232A-10) EXPERIMENTAL PHYSICS. Annual Report, July 1, 1973–June 30, 1974. Cool, R. L. (Rockefeller Univ., New York (USA)). 1974. 5p. Dep. NTIS $4.00.

Experimental research on high energy physics is summarized. (JFP)

7155 EXPERIMENTAL PROGRAM AT THE PS AND ISR. CERN Cour.; 10: No. 14, 337-344(Oct 1974).

The current research program at CERN is briefly described. The experiments are listed according to the experimental hall in which they are located. (WHK)

7156 SEARCH FOR COSMIC RAY QUARKS AT LARGE ZENITH ANGLES. Kifune, Tadashi (Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science); Hieda, Yasuo; Kurokawa, Shinichi; Tsunemoto, Kenji; Kimura, Yoshitaka. J. Phys. Soc. Jap.; 36: No. 3, 629-633(Mar 1974).

Fractionally charged particles (quarks) were looked for in cosmic rays at sea level. The detection system consists of six layers of scintillation counter hodoscopes, and is directed to large zenith angles so that quarks are detected isolated from air showers due to their interactions with the thick atmospheric layer. The total acceptance of the present measurement amounts to 1.1×10^{10} cm^{2}sr sec. The upper flux limit of 3×10^{-10} cm^{-2}-sr^{-1}sec^{-1} is obtained for e/3 quarks at large zenith angles. From this flux limit, a lower limit of the quark mass is estimated to be about 20 GeV/c^2. (auth)

Electromagnetic

7157 (KFTI-73-24, pp 97-98) DENSITY OPERATOR AND STATISTICS OF THE SYNCHROTRON RADIATION PHOTONS. Naugol'nyj, N. N.; Tarasenko, A. S. 1973. (In Russian).

From final seminar of the accelerator section of the KFTI AN Ukrainian SSR; Kharkov, Ukrainian SSR (Jan 1973).

In nuclear science and engineering problems. Ser. High energy physics and nuclear physics.

The statistics of photons of the synchrotron radiation of relativistic bunches of charged particles were studied. The results are of interest for studying the statistical properties of electromagnetic fields of a different type of activation in connection with making quantum radiation generators. (INIS)

7158 LATERAL DISTRIBUTION OF RADIO EMISSION FROM COSMIC RAY AIR SHOWERS. Castle, R. J. Ann Arbor, MI; Univ. of Michigan (1974). 152p. University Microfilms Order No. 74-25,169.

Thesis (Ph. D.).

Radio pulses from extensive air showers were detected by an experiment performed at the Bolivian Air-Shower Joint Experiment (BASJE) array located at an altitude of 5200 meters and geomagnetic latitude of 4°S on Mt. Chacaltaya in Bolivia. Five log-periodic antennas were used to detect the radio pulses. Four of these antennas were operated in a broad band mode (pre-detector bandwidth = 54 MHz), narrow band (3.5 MHz) mode; the narrow band channels, which were tapped off the broad band signal, were located at frequencies of 55 MHz, 83 MHz, and 175 MHz. Three hundred and thirteen showers out of 2340 had detectable radio pulses. By comparing arrival directions and arrival times (i.e., orientation and position) of the radio and particle fronts as measured independently by the antenna array and by the BASJE particle array it was found that the radio front coincides with the particle front of the EAS. Thirty events, arriving within the half-power cone of the antennas and having a radio pulse in at least three antennas, were used to study the lateral distribution of radio pulses which was found not to be a simple monotonically decreasing function of distance from the shower axis. One group of sixteen events has a plateau, of constant electric field intensity, which extends for about a hundred meters from the shower axis and for those events (13) which arrived during good weather the magnitude of this plateau electric field is proportional to the number of particles at the shower maximum as deduced from the shower size and zenith angle measured at BASJE. For a second group of nine events the electric field intensity does fall off with distance from the shower axis, however, the pulse heights (field intensities) of this group do not correlate with shower particle parameters. These lateral distribution phenomena are explained on the basis of a very simple model of an air shower as a disk of negligible thickness emitting coherent radiation; the lateral distribution of radio pulses is taken to be the result of the Fresnel diffraction of this radiation. Representative diffraction patterns were computed and are found to agree with the data. For plateau radio pulse events recorded during good weather the best fit of the pulse height to the maximum size of the shower occurs when the geomagnetic mechanism is assumed to be the origin of the radiation. For radio pulse events recorded during snow storms there appears to be no correlation between pulse heights and the shower size at maximum—it is speculated that the large atmospheric electric fields during snow storms are responsible for this behavior. Finally the data from the narrow band channels show that the intensity of the radiation decreases sharply with increasing frequency though the data are insufficient to provide a quantitative relation. (Diss. Abstr. Int., B)

Weak

Refer also to abstract 7249.

7159 (PITHA-62(1972)) MEASUREMENT OF THE CP VIOLATING DECAY RATE OF THE LONG-LIVED NEUTRAL KAON INTO TWO NEUTRAL PIONS BY COMPARING IT TO THE ALLOWED DECAY INTO THREE NEUTRAL PIONS. Reithler, H. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalisches Inst.). 6 Jul 1972. 99p. (In German). INIS.

51 figs.; 3 tabs.; 46 refs. With abstract. Available from the library of the Technische Hochschule Aachen.

The gamma quanta of the decays $K^0(L) \to 2\pi^0 \to 4\gamma$ and $K^0(L) \to 3\pi^0 \to 6\gamma$ have been recorded with the help of thick-walled spark chambers. The number of $2\pi^0$-decays has been known from a previous analysis [Gaillard et al., Nuovo Cim. 59A (1969) 453]. The kaon flux from the $K^0(L) \to 3\pi^0$ decays recorded on the same film is determined. It is shown that the $3\pi^0$ decays are practically without background. The measured branching ratio is $R[K^0(L) \to 2\pi^0]/R[K^0(L) \to 3\pi^0] = (0.90 \pm 0.30) \times 10^{-2}$ and yields the value $\eta_{00} = (3.2 \pm 0.5) \times 10^{-3}$ for the CP violation parameter. (GE)

7160 NEUTRAL CURRENTS. Rousset, A. (CERN, Geneva). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 141-165 (1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

An analysis is given of four neutrino experiments which are giving today positive evidence in favor of weak neutral current interactions: the search for muon neutrino elastic scattering on electrons in Gargamelle at CERN, the search for inclusive semi-leptonic neutrino and antineutrino reactions in Gargamelle at CERN, the search for the same reactions but at higher energies at NAL in the 1A experiment, and the search for one pion channel in the Argonne 12 feet bubble chamber. (auth)

Strong (Baryon-induced)

Refer also to abstracts 7241 and 7446.

7161 (CERN-74-18, pp 3-8) SINGLE-PION PRODUCTION NEAR THRESHOLD. Schultz, J.; Burns, R. R.; Condon, P. E.; Donahue, J.; Mandelkern, M.; Price, L. R.; Smith, D. (Univ. of California, Irvine). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Results on single pion production from an exposure of 220,000 pictures of antiprotons in a bubble chamber at 0.7 to 1.1 GeV/c are reported for the reactions $\bar{p}p \to \bar{p}p\pi^0$, $\bar{p}n\pi^+$, and $\bar{n}p\pi^-$. The cross sections are discussed. (JFP)

7162 (CERN-74-18, pp 9-27) $\bar{p}p$ ANNIHILATIONS INTO STRANGE PARTICLE FINAL STATES AT 700 TO 750 MeV/c. Aguilar-Benitez, M. (Junta de Energia Nuclear, Madrid); Barreiro, F.; Cerrada, M. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

A review is given of some recent results from a $\bar{p}p$ experiment at 700 to 750 MeV. These results include the total and differential cross sections, K(890) mass difference for neutral and charged states, and the $K\bar{K}$ threshold enhancement. (JFP)

7163 (CERN-74-18, pp 28-36) EXPERIMENTAL ANALYSIS OF THE REACTION $\bar{p}p \to \pi^+\pi^-\pi^+\pi^-\pi^0$ AT REST (NON-ω^0 EVENTS). Evidence for a Rho^{0}Rho^0 Effect Around 1440 MeV.

Defoix, C.; Espigat, P. (College de France, Paris). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

A sample of 25,000 $\bar{p}p \to 2\pi^+ 2\pi^- \pi^0$ annihilations at rest is studied in a hydrogen bubble chamber. Evidence is found for a $(\rho^0\rho^0)$ effect which can be put together with the $X(I^G = 0^+)$ object found previously. Also rates are found for the different channels. (JFP)

7164 (CERN-74-18, pp 90-95) REACTION $\bar{p}p \to \bar{n}n$ WITH ANTIPROTON MOMENTUM IN THE RANGE 700 TO 750 MeV/c. Bombay-CERN-Neuchatel-Tokyo Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Preliminary results are presented based on one-third of the entire data on differential cross sections of the charge exchange reaction $\bar{p}p \to \bar{n}n$. (JFP)

7165 (CERN-74-18, pp 97-101) ANTIPROTON-PROTON BACKWARD ELASTIC SCATTERING BETWEEN 1.50 AND 2.04 GeV/c. Glasgow-Lausanne-Liverpool-Neuchatel Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Preliminary results are presented on a study of $\bar{p}p$ backward elastic scattering at 1.50 to 2.04 GeV/c in a bubble chamber in order to study the U meson region. Differential cross sections are given. (JFP)

7166 (CERN-74-18, pp 110-114) CROSS-SECTIONS FOR THE REACTION $\bar{p}p \to K\bar{K}n\pi$ (n = 3,4) BETWEEN 1.50 TO 2.04 GeV/c. Glasgow-Liverpool-Lausanne/Neuchatel-Paris (IPN) Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Cross sections for the reaction $\bar{p}p \to K\bar{K}n\pi$ (n = 3,4) between 1.50 and 2.04 GeV/c are presented and show a bump only in the U mass region. The percentage of ω^0 production is also found for various momenta. (JFP)

7167 (CERN-74-18, pp 115-130) ANGULAR DISTRIBUTIONS OF $\bar{p}p \to \pi^0\pi^0$ AND $\bar{p}p \to \pi^0\text{eta}^0$ AT 1.752 GeV/c. DeMarzo, C. (Bari Univ., Italy); Guerriero, L.; Posa, F. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Preliminary results of an optical spark chamber experiment to measure gamma ray final states of proton - antiproton annihilations are presented. Angular distributions are given for $\bar{p}p \to 2\pi^0$ and $\bar{p}p \to \pi^0\eta^0$ at 1.752 GeV/c incident momentum. (JFP)

7168 (CERN-74-18, pp 142-145) REACTION $\bar{p}p \to K^0_1 K^+ \pi^+$ BETWEEN 1.50 TO 2.04 GeV/c. Glasgow-Lausanne/Neuchatel-Liverpool-Paris (IPN) Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Some results are presented based on 966 events found for the $\bar{p}p \to K^0_1 K^+(K^-)\pi^-(\pi^+)$ reaction at 1.50 to 2.04 GeV/c in a hydrogen bubble chamber. The effective mass distributions and production percentages for the resonances K^* and K in various charge states and for A_2. Also a lower limit on the degree of polarization was found. (JFP)

7169 (CERN-74-18, pp 172-175) REACTION $\bar{p}p \to \bar{p}p2\pi^+2\pi^-$ AT 3.6 GeV/c. Bartke, J. (Inst. of Nuclear Physics, Krakow). 20 Sep 1974.

Fron international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (26 Jun 1974).

The cross section of the reaction $\bar{p}p \to \bar{p}p2\pi^+2\pi^-$ at 3.6 GeV/c was determined to be 9 ± 2 μb. The angular distribution asymmetry is also discussed. (JFP)

7170 (CERN-74-18, pp 248-254) ANTIPROTON-DEUTERIUM INTERACTIONS AT 14.6 GeV/c. Fridman, A. (CRN, Strasbourg). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The cross sections and d^* and Δ production in $\bar{p}d \to \bar{p}d\ \pi^+\pi^-$ and p, $\bar{p}p\ \pi^-$ interactions at 14.6 GeV/c are discussed. (JFP)

7171 (CERN-74-18, pp 269-280) MULTIPLICITY DISTRIBUTION OF $\bar{p}p$ INTERACTIONS IN THE HIGH ENERGY REGION. Kitagaki, T.; Tanaka, S.; Abe, K. (Tohoku Univ., Sendai). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The charged-particle multiplicity distribution and average number of π^0 in $\bar{p}p$ interactions in the high energy region are studied. It is found that the shape parameter W of charged multiplicity is equal to about two, and that π^0 production has positive correlation with π^+ and π^- production in the 15-GeV $\bar{p}p$ interactions. The s-dependence of W has a positive slope. It is shown that neither the annihilation process nor the nonannihilation process has high energy behavior. (JFP)

7172 (CERN-74-18, pp 281-287) ANALYSIS OF TOPOLOGICAL CROSS SECTIONS IN $\bar{p}p$ INTERACTIONS AT 22.4 GeV/c. Dubna-Helsinki-Kosice-Moscow-Prague-Tbilisi Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The number of events for different topologies as well as the corresponding cross sections are presented for $\bar{p}p$ interactions at 22.4 GeV/c. Early scaling and multiplicity distributions are considered. (JFP)

7173 (CERN-74-18, pp 344-348) DIFFRACTIVE PROCESSES IN $\bar{p}p$ INTERACTIONS AT 5.1 GeV/c. Bastien, D. B. (Massachusetts Inst. of Tech., Cambridge); Hodous, M. F.; Hulsizer, R. I.; Napier, A.; Pless, I. A.; Silverman, J. P.; Wolfson, J.; Bastien, P. L.; Kirkpatrick, L. D.; Lubatti, H. J. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Various final states were separated for the $\bar{p}p \to \bar{p}p\pi^+\pi^-$ interactions at 5.1 GeV/c. The distribution of all events in the energy simplex and in the Van Hove angles is shown. The quasi-three-body prism plot is obtained, and the invariant mass distributions are shown. It is believed that these represent the diffractive dissociation of the proton with subsequent decay into $\Delta\pi^-$. It is concluded that 30% of the $\bar{p}p \to \bar{p}p\pi^+\pi^-$ results from diffractive dissociation of the proton and antiproton. (JFP)

7174 (CERN-74-18, pp 355-360) t' DISTRIBUTION FOR $\bar{p} \to \bar{p}\pi^-$ IN THE REACTION $\bar{p}p \to \bar{p}p\pi^-\pi^+$ AT 7.3 GeV/c. van Apeldoorn, G. W.; van de Grint, F. J.; Harting, D.; Holthuizen, D. J.; van Leeuwen, W. M.; Rijssenbeek, M. M. H. M.; Voetelink, C.; Warmerdam, J. M. (Univ., Amsterdam). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

In the analysis of the t' distribution for $\bar{p} \to \bar{p}\pi^-\pi^+$ at 7.3 GeV/c the logarithm of the number of events was plotted as a function of $-t'$ ($t' = t - t_{max}$, t between $\bar{p}$ and $\bar{p}\pi^-$). A kink is found in the slope at $t' = -0.07$. The value of the slopes is higher at 7.3 GeV/c than at 5.7 GeV/c. (JFP)

7175 (CERN-74-18, pp 361-377) FEATURES CONNECTED WITH THE USE OF DEUTERON TARGETS IN $\bar{p}d$ INTERACTIONS AT 5.55 GeV/c. Fridman, A. (CERN, Geneva). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Some typical aspects related to the utilization of deuteron targets in fast $\bar{p}$ induced reactions are discussed. The results obtained at 5.55 GeV/c from a bubble chamber experiment are mainly emphasized. Elastic $\bar{p}d$ and $\bar{p}n$ scattering, inelastic coherent production, and search for a Δ-Δ component in the deuteron wave function with some aspects of coherent production are covered. (JFP)

7176 (CERN-74-18, pp 379-382) POLARIZATION AND CORRELATION COEFFICIENTS OF Λ'S AND $\bar{\Lambda}$'S IN THE REACTION $\bar{p}p \to \bar{\Lambda}\Lambda$ BETWEEN 1.50 TO 2.04 GeV/c. Glasgow-Liverpool-Lausanne/Neuchatel-Paris (IPN) Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The asymmetry parameters, polarization, and spin correlation coefficients for the reaction $\bar{p}p \to \bar{\Lambda}\Lambda$ at 1.50 to 2.04 GeV/c were studied using a hydrogen bubble chamber. (JFP)

7177 (CERN-74-18, pp 383-388) $\bar{p}p$ ELASTIC SCATTERING AND TWO-BODY ANNIHILATIONS AT 6.2 GeV/c. CERN-Ecole Polytechnique-Geneva-Orsay-Stockholm Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Cross sections for $\bar{p}p$ annihilation at 6.2 GeV/c are reviewed as studied recently by a proportional and spark-chamber experiment. The annihilations into K^+K^- and $\pi^+\pi^-$ and a comparison of $\bar{p}p \to \bar{p}p$ with the $pp \to pp$ data are considered. (JFP)

7178 (CERN-74-18, pp 390-397) $\bar{p}p \to \bar{p}p\pi^+\pi^-$ REACTIONS AT 7 GeV/c. Kitagaki, T. (Tohoku Univ., Sendai); Tanaka, S.; Abe, K. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The topological and isobar production cross sections for $\bar{p}p \to \bar{p}p\pi^+\pi^-$ reactions at 7 GeV/c are given. The $\bar{\Delta}^{--}\Delta^{++}$, $\bar{\Delta}^0\Delta^0$, and

N(1470) production and Δ decay angular distribution in the $\bar{\Delta}\Delta$ channel are discussed. It is suggested that most single isobar final states come through the diffraction dissociation-like process. (JFP)

7179 (CERN-74-18, pp 398-403) COMPARISON OF $\bar{p}p$ AND pp ELASTIC SCATTERING AT 90°. Eisenhandler, E. (Queen Mary Coll., London); Gibson, W. R.; Hojvat, C. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

A study of low momentum antiproton - proton interactions in the momentum range 0.7 to 2.4 GeV/c yields the differental cross sections for the elastic channel. An observation is given of one property of the data when compared with elastic scattering in the quark - parton model is made. The pp and $\bar{p}p$ systems related by crossing symmetry provided significant constraints on any particular model. (JFP)

7180 (CERN-74-18, pp 436-446) INCLUSIVE VIEW OF $\bar{p}p \rightarrow n\pi$ at rest. CERN-College de France Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Some properties that might be added to the intermediate cluster model are deduced, and some insight in the field of high energy interactions is given. The single particle inclusive spectra in $\bar{p}p \rightarrow n\pi$ at rest and in clusters is compared. (JFP)

7181 (COO-2232B-58) PHENOMENOLOGICAL ANALYSIS OF TOTAL CROSS SECTION MEASUREMENTS AT N. A. L. Hendrick, R. E.; Langacker, P.; Lautrup, B. E.; Orfanidis, S. J.; Rittenberg, V. (Rockefeller Univ., New York (USA)). 1974. Contract AT(11-1)-2232. 63p. Dep. NTIS $6.25.

The available high energy total cross section data for $\pi^{\pm}$, $K^{\pm}$, p, and $\bar{p}$ scattering on protons and deuterons are analyzed. It is found that the diffractive (nonfalling) components of the cross sections are compatible with several different functional forms for the energy dependence, including one in which σ_{K^+p}, σ_{π^+p}, and σ_{pp} will rise asymptotically as ln s with coefficients in the ratios predicted by SU(3) and the naive quark model. The falling components of the cross sections are found to be in striking agreement with Regge theory. The ρ and ω intercepts are found to be $\alpha_\rho = 0.57$ and $\alpha_\omega = 0.43$. A comparison with forward nondiffractive cross sections verifies the ρ and ω Regge pole phases. The data are in strong agreement with universality, are compatible with exchange degeneracy, and indicate a substantial breaking of SU(3). Glauber screening corrections, with inelastic contributions added, are calculated and used to predict the total cross sections for scattering on deuterium. The predictions are in excellent agreement with the data. (auth)

7182 PRODUCTION OF NEGATIVE AND NEUTRAL PARTICLES EMITTED AT THE FRONT OF THE CERN STORAGE RING. Dimcovski, Z. Orsay, France; Paris Univ. (1974). 110p.

Thesis.

The results discussed were obtained with a magnetic spectrometer detecting negative particles emitted at small angles at the CERN Intersecting Storage Rings (ISR). The presentation is divided into four parts: Inclusive spectra of π^-, K^-, $\bar{p}$ at ISR energies of $\sqrt{s}$ = 23, 31, 45, 53, and 63 GeV; correlations between π^-, K^-, and $\bar{p}$ detected in the spectrometer and n detected in a neutron detector with the overall distribution of charged particles produced in the same pp interaction, as detected by the Pisa-Stony Brook hodoscope system; results on π^-/K^- separation and search for quarks performed with a multilayer relativistic rise detector consisting of 30 proportional gas counters. (auth)

7183 UPPER LIMITS ON THE PRODUCTION OF PARTICLES WITH CHARM QUANTUM NUMBERS IN PP COLLISIONS AT 400 GeV/c. Ferbel, T. (Univ. of Rochester, NY). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 393-395(1974).

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

Upper limits are discussed for the production of particles with charm quantum numbers in pp collisions at 400 GeV/c. (auth)

Strong (Meson-induced)

Refer also to abstract 6138.

7184 (CERN-74-18, pp 37-42) PRESENT STATUS OF THE $\omega\pi\pi$ DECAY OF THE A_2 FROM THE $\bar{p}p$ ANNIHILATIONS AT 700 MeV/c. Defoix, C.; Dobrzynski, L.; Espigat, P. (College de France, Paris). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Some partial results on the properties of the $\omega^0\pi\pi$ decay mode of the A_2 are presented from an increase of the $\bar{p}p$ sample by a factor of two. (JFP)

7185 (CERN-74-18, pp 46-75) FORMATION OF HIGH MASS MESONS. Astbury, A. (Rutherford Lab., Didcot, Eng.). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

A review is given of the formation of high mass mesons including nucleon - antinucleon formation, the total cross sections with measurements and interpretation of structure, new data on charge exchange, elastic scattering, annihilation into two mesons, and a list of some states which have not been confirmed. The future outlook is also discussed. (JFP)

7186 (CERN-74-18, pp 77-89) INDICATIONS OF $J^{PC} = 4^{++}$ FOR S(1930) MESON FROM AN $\bar{p}p$ BACKWARD ELASTIC SCATTERING EXPERIMENT. d'Andlau, C. (College de France, Paris); Cohen-Ganouna, J.; Della-Negra, M.; Laloum, M.; Lutz, P.; Petri, C. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The results of a study on the indications of $J^{PC} = 4^{++}$ for the S(1930) meson from a $\bar{p}p$ backward elastic scattering experiment show a nonexcluded diffractive origin of the backward peak, but this appears quite unlikely according to the presented arguments on angular stability, characteristic energy behavior, the absence of any forward slipping afterwards. Also the perfect agreement obtained for all the quantum numbers with the Regge expectations $(J^P I^G) = (4^+1^-)$ reinforces the probability of a resonant nature. A recent confirmation is noted. (JFP)

7187 (CERN-74-18, pp 102-103) EXPERIMENTAL STUDY OF $\bar{p}n$ ANNIHILATIONS BETWEEN 1.0 AND 1.6 GeV/c. Alston-Garnjost, M. (Univ. of California, Berkeley); Huesman, R. H.; Ross, R. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The $\bar{p}n$ annihilations into three and five charged mesons with or without neutrals were studied in order to measure the contributions of the various final states to the 5.5 mb enhancement discovered in the total I = 1 $\bar{N}N$ cross sections at 2190 MeV total cm energy. Fits were made to the cross sections as functions of incident momentum. The results of the fits are shown. Enhancements are present in various final states the most significant of which appears in the reaction $\bar{p}n \rightarrow \pi^+2\pi^-$. (JFP)

7188 (CERN-74-18, pp 105-107) SEARCH FOR $RHO^0RHO^0\pi^-$ ENHANCEMENT IN ANTIPROTON-NEUTRON ANNIHILATION IN THE T-MESON REGION. Smith, G. A. (Michigan State Univ., East Lansing). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The reaction $\bar{p}d \rightarrow p_s\ \rho^0\rho^0\pi^- \rightarrow p_s\ 2\pi^+\ 3\pi^-$, where p_s is a spectator proton, at 1.06 to 2.90 GeV/c was studied. No enhancement is observed in the cross sections. (JFP)

7189 (CERN-74-18, pp 132-141) PRODUCTION OF RESONANCES IN THE T + U REGION. Glasgow-Lausanne-Liverpool-Neuchatel-LPNHE Paris Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Preliminary results on $K\pi\pi$ and $K\bar{K}\pi$ production of resonances in pp annihilation are presented. The $\bar{p}$ momentum covers the range 1.28 to 2.04 GeV/c and spans the T + U region. In the $K\pi\pi$ spectrum two bumps at masses 1250 (C) and 1320 (C') MeV/c^2 are found in the Q region. In the $K\bar{K}\pi$ spectrum the triplet $D^0(1280)$, $E^0(1420)$, and $F_1(1540)$ are seen clearly in the various channels. The quantum numbers of the F_1 are discussed. (JFP)

7190 (CERN-74-18, pp 146-150) SEARCH FOR AN I = 1 RESONANCE IN THE $\bar{p}p \rightarrow K^0_1K^+\pi^+\pi^-$ REACTION, IN THE 1970-MeV MASS REGION. Glasgow-Liverpool-Lausanne/Neuchatel-Paris (IPN) Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (26 Jun 1974).

The percentages of resonances produced in the $\bar{p}p \rightarrow K^0_1K^+(K^-)$ $\pi^-(\pi^+)\pi^+\pi^-$ reaction at 1.50 to 2.04 GeV/c are given. The resonances found are the various charge states of K^*, ρ^0, D^0, E^0, F^0_1, and A_2. (JFP)

7191 (CERN-74-18, pp 189-205) FRAGMENTATION K^- + $p \rightarrow \Lambda^0$ + ... AT 4.2 GeV/c. Amsterdam-CERN-Nijmegen. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (26 Jun 1974).

Target and beam fragmentation processes were studied in $K^-p \rightarrow \Lambda$ + pions reactions at 4.2 GeV/c. The various distribu-

tions and pion multiplicities as well as cross section contributions from the production of Λ^0, π^0, η (550), ρ (770), ω (785), η' (960), ϕ(1020), f(1270), and A_2 (1310) are considered. There is a confirmation of the predictions that the annihilation K^+ and K^- into pions should proceed via intermediate resonances only. (JFP)

7192 (CERN-74-18, pp 428-435) NEW FASHION IN ANGULAR CORRELATIONS. Schlesinger, J. (Univ., Mons, Belg.). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Preliminary results on correlations between pions, in the exclusive reaction $K^+p \rightarrow K^+p2\pi^+2\pi^-$ interactions at 8.25 GeV/c are presented. The results obtained by a new method due to Kpylov and Podgeretsky are compared with space angle and transverse momentum plane correlations. Similar investigations are suggested for $\bar{p}p$ annihilations. (JFP)

7193 (JINR-P1-8164) DESCRIPTION OF THE REACTION $\pi^-p \rightarrow p\pi^+\pi^-\pi^-$ IN THE ONE-PION EXCHANGE REGGEIZED MODEL AT 5 AND 16 GeV/c. Boreskov, K. G.; Glagolev, V. V.; Emel'yanenko, V. N.; Lebedev, R. M.; Ponomarev, L. A.; Patochka, I.; Saitov, I. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The $M_{\pi^+\pi^-}$, $M_{\pi^-\pi^-}$, $M_{p\pi^+}$, $M_{p\pi^-}$, $M_{\pi^+\pi^-\pi^-}$-distributions for the reaction $\pi^-p \rightarrow p\pi^+\pi^-\pi^-$, obtained in experiments at 5 and 16 GeV/c, at the t-distributions for the same reaction at 5 GeV/c are compared to the predictions of the OPER model with the following form factor $F_2 = \exp\{[R_2^2 + \alpha'_\pi \ln(\frac{s}{s_0}\frac{k_1^2}{s_1}\frac{k_2^2}{s_2})](t-\mu^2)\}$. The corresponding distributions were calculated by the OPER model at fixed parameters whose values were determined from the analysis of double-pion production for the reaction $pp \rightarrow pp\pi^+\pi^-$. Using the same parameters, the dependence of the cross section of the given reaction on the momentum of the incident particle in the region between 2 and 205 GeV. The proposed model satisfactorily describes, using the same parameters, the characteristics of the reaction $\pi^-p \rightarrow p\pi^+\pi^-\pi^-$ in a wide range of energies. (auth)

7194 K^+d CHARGE-EXCHANGE SCATTERING BELOW 600 MeV/c. Rosenblatt, G. Chicago; Illinois Inst., of Tech. (1974). 119p. University Microfilms Order No. 74-23,995.

Thesis (Ph. D.).

The differential and total cross sections for K^+d charge-exchange scattering at 252, 342, 469, and 587 MeV/c were measured in an experiment. The data were extracted from events obtained by exposing the Brookhaven National Laboratory 30-inch deuterium bubble chamber to a separated beam of K^+ mesons. A phase shift analysis of the differential charge-exchange cross section at each momentum was carried out assuming that the T = 1 channel is pure s-wave. These analyses indicate that the inclusion of s- and p-waves in the T = 0 channel provides a satisfactory and consistent description of the charge-exchange reaction in this momentum interval. A comparison of the results with previous experiments is included. (Diss. Abstr. Int., B)

7195 EXPERIMENTAL MESON SPECTROSCOPY: 1974. Fourth International Conference Held at Boston, Massachusetts, April 26-27, 1974. Garelick, D. A. (ed.). AIP Conference Proceedings, Number 21. Particles and Fields Subseries No. 8. New York; American Institute of Physics (1974). 462p. (CONF-740408-).

Separate abstracts were prepared for each of the 28 papers included. The 146 contributed papers are title listed in an appendix. (JFP)

For abstracts of individual papers see: 7183, 7196–7204, 7209, 7233, 7234, 7256, 7270–7281, 7293, and 7294.

7196 AMPLITUDE ANALYSIS OF $(3\pi)^+$ PRODUCTION AT 7 GeV/c. Tabak, M. (Univ. of California, Berkeley); Ronat, E. E.; Rosenfeld, A. H.; Lasinski, T. A.; Cashmore, R. J. AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 46-58(1974).

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

An amplitude analysis of the reaction $\pi^+p \rightarrow p(\pi^-\pi^+\pi^+)$ at 7 GeV/c is in progress. Although the method of analysis and assumptions are quite different from those of the Illinois group, preliminary results are nevertheless consistent with theirs. Coherent amplitudes are fit, not the density matrix, and different assumptions are made about decay amplitudes of J^P states into various isobars. This approach, furthermore, allows one to probe a much larger set of partial waves than that quoted by the Illinois group, at the expense of imposing explicit rank conditions on the density matrix. (auth)

7197 COMMENTS ON HEAVY MESONS. Dalitz, R. H. (Oxford Univ.). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 75-78(1974).

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

A discussion is given of the existence of two narrow resonances lying near the $\bar{N}N$ threshold at 1795 and 1932 MeV. It appears possible that in the approximately linear rise observed in the production cross section ratio for $e^+e^- \rightarrow$ hadrons interactions in colliding beams one is observing the onset of the excitation of a very heavy vector meson, the gluon G of mass M_G, which has been hypothesized by many as the origin of the internal binding between the quark-like partons within hadronic states. (JFP)

7198 REVIEW OF EXOTIC MESONS. Cohen, D. (Columbia Univ., New York). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 79-96(1974).

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

Recent data pertaining to exotic mesons is presented. Unambiguous evidence now exists for the occurrence of reactions proceeding via exchanges involving exotic quantum numbers, although the interpretation of such reactions remains unclear. Exotic mesons were searched for in both meson exchange and baryon exchange reactions, and no evidence was found for their existence. (auth)

7199 NEW RESULTS ON $K\pi\pi$. Hansen, J. D. (Niels Bohr Inst., Copenhagen). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 173-191(1974).

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

New results on the reaction $K^-p \rightarrow K^-\pi^+\pi^+p$ at incident momenta from 10 to 40 GeV/c and on the reaction $K^-p \rightarrow \bar{K}^0\pi^+\pi^-n$ at incident momenta from 8 to 16 GeV/c are presented. Both reactions show spin parity structures similar to the reaction $\pi p \rightarrow \pi\pi^-\pi^+p$. Details of the Q-region are discussed. (auth)

7200 COHERENT NUCLEAR PRODUCTION OF MESONS. Russ, J. S. (Carnegie-Mellon Univ., Pittsburgh). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 237-258(1974).

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

The coherent production of $(3\pi)^-$ systems from nuclear targets is considered, with emphasis on results from a high statistics (130,000 reconstructed events) experiment at 23 GeV/c by the Carnegie-Mellon-Northwestern-Rochester collaboration. Features of diffractive dissociation in the coherent process are compared with diffractive data from hydrogen. The momentum dependence of the coherent yield and the multiparticle absorption cross sections in nuclear matter are discussed. Coherent nuclear A_2 production is seen. (auth)

7201 INCLUSIVE MESON RESONANCE PRODUCTION. Winkelmann, F. C. (Univ. of California, Berkeley). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 259-280(1974).

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

The status of inclusive meson resonance production is reviewed. New data are presented on inclusive ρ^0 production in 205 GeV/c π^-p interactions. (auth)

7202 VECTOR MESON PRODUCTION IN SEMI-INCLUSIVE π-p INTERACTIONS. Levy, A.; Brick, D.; Hodous, M.; Hulsizer, R.; Kistiakowsky, V.; Miller, P.; Nakkasyan, A.; Pless, I.; Simak, V.; Trepagnier, P.; Wolfson, J.; Yamamoto, R. (Massachusetts Inst. of Tech., Cambridge). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 281-287(1974).

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

A sample of events taken in the SLAC 82" chamber and measured by PEPR was studied. These events contain an identified proton with momentum less than 1 GeV/c. The produced ρ^0 and ω in these events were isolated and they could be classified as to production mechanism. It is found that these vector mesons are mainly decay products of diffractively produced mesons. (auth)

7203 PROSPECTS IN MESON SPECTROSCOPY. Leith, D. W. G. S. (Stanford Univ., CA). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 399-429(1974).

From 4th international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

A review of the prospects for experimental meson spectroscopy is presented. The history of baryon spectroscopy is given, and the lesson for meson studies is underlined. Several areas of new opportunity for meson experiments are described—namely, the new multiparticle spectrometers, their application to photoproduction investigations, and the new generation of e^+e^- colliding beam facilities. Accumulating evidence for the existence of meson towers is presented. Finally, the possible use of high energy and large momentum transfer to give a new (more democratic) look at the meson world is discussed. (auth)

7204 REVIEW OF PARTICLE PROPERTIES. Chaloupka, V. (CERN, Geneva); Bricman, C.; Barbaro-Galtieri, A. AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 430-434(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

Various meson properties are listed in a table. (JFP)

7205 NATURE OF THE A_3 MESON. Beketov, G. V.; Zombkovskii, S. M.; Kaidalov, A. B.; Konovalov, B. S.; Kruchinin, S. P.; Pozhidaeva, N. A.; Selektor, Ya. M.; Turov, V. F.; Shulyachenko, V. N. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 4, 709-716(Oct 1974). (In Russian).

The A_3-meson production from the reaction $\pi^-p \to p\pi^+\pi^-\pi^-$ at 4.45 GeV/c was studied using liquid-hydrogen bubble chambers. The data were compared with the predictions of the Regge-pole exchange model. The model explains all main features of the A_3-meson production and decay (the value and the shape of the A_3 maxima in 3π and $f\pi$ mass spectra, the momentum transfer distributions, the angular distributions of the normal direction to the $A_3 \to f\pi$ decay plane, the angular distribution of the f-meson decay from the A_3 maximum, the Treiman–Yang angular distributions). All the data are in good agreement with the suggestion that the A_3 maximum is related mainly to the kinematic reflection of peripheral diagrams. The helicity conservation in the A_3 meson production from the reaction $\pi^-p \to A_3^-p$, $A_3^- \to f^0\pi^-$ was also studied. It is shown that neither s-channel nor t-channel helicity is conserved in this reaction. The model considered reproduces also these features of the data. (auth)

Particle Interactions and Properties (Theoretical)

General

7206 (CERN-74-18, pp 447-486) TREATING MULTIPARTICLE PROCESSES. Kittel, W. (Univ., Nijmegen, Netherlands). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The discussion of the treatment of multiparticle processes covers the cluster search, individual clusters, and multichannel analysis. (JFP)

7207 (JINR-E2-8126) RELATIVISTIC FORM FACTORS OF COMPOSITE PARTICLES. Faustov, R. N.; Garsevanishvili, V. R.; Kvinikhidze, A. N.; Matveev, V. A.; Tavkhelidze, A. N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 28p. Dep. NTIS (US Sales Only) $4.50.

A theory of form factors of composite particles is developed on the basis of the relativistically covariant quasipotential equations. (auth)

7208 (JINR-P2-8055) INTERACTIONS DEPENDING ON RAPIDITIES IN MULTIPARTICLE PRODUCTION AT HIGH ENERGY. Mal'tsev, V. M.; Dushutin, N. K.; Sinegovskii, S. I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

Possible interactions depending on rapidities in multiparticle production processes are considered. A physical interpretation of these interactions is given. A comparison with the available experimental data is made. (auth)

7209 CHARM: AN INVENTION AWAITS DISCOVERY. Glashow, S. L. (Harvard Univ., Cambridge, MA). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 387-392(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

The discussion of charm covers the properties of charm, the need for charm, what charmed hadrons do, and charm observed in hadron spectroscopy, neutrino physics, and e^+e^- annihilation. (JFP)

7210 DUAL RESONANCE MODELS. Frampton, P. H. Frontiers in Physics, Number 45. Reading, PA; Addison-Wesley/W. A. Benjamin, Inc. (1974). 468p. $22.50.

The following topics are covered: duality, multiparticle dual model, operator formalism, internal symmetry, spin, symmetric group, and phenomenological applications. (JFP)

7211 PRODUCTION OF ELEMENTARY PARTICLES IN ELECTROMAGNETIC AND GRAVITATIONAL FIELDS. Zeldovic, J. Veda Tech. SSSR; 1: No. 5, 41-44(Oct 1973). (In Czech).

The history is briefly discussed of the theory of elementary particle production in electromagnetic and gravitational fields. Also discussed is the significance of the study of particle production with regard to its envisaged applications in other physical and astrophysical fields. The reasons are explained for which the research of particle production in electromagnetic and gravitational fields is considered to be one of the most interesting and most important tasks for the nearest future. (auth)

7212 GROUP AND DYNAMICS OF PARTICLES. Noga, M. (Komenskeho Univerzita, Bratislava (Czechoslovakia). Prirodovedecka Fakulta). Acta Phys. Slovaca; 23: No. 2, 108-117 (1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (22 Sep 1971).

A classification of various dynamical models which resulted in dynamical algebraic relations identical with the Lie algebras of certain Lie groups is surveyed. The groups are not necessarily symmetry groups of the Hamiltonian of the physical system and are referred to as dynamical groups, noninvariant groups, or spectrum generating groups. (auth)

7213 OPERATOR PRODUCT EXPANSIONS AND HIGH MASS PHENOMENOLOGY. Kummer, W. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). Acta Phys. Slovaca; 23: No. 2, 68-75(1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (22 Sep 1971).

A description of product expansion of operators at light-like distances is given. It is shown that the field of light-cone physics does not include only the "traditional" applications of deep inelastic electron-proton scattering and similar situations where a large four momentum is transferred from an external lepton line. The light cone is also tested for certain cases where an internal integration is dominated by cut-offs or propagators with large masses. (auth)

7214 DISPERSION THEORY OF LOW ENERGY PARTICLE-RESONANCE SCATTERING. Kurpa, D. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Acta Phys. Slovaca; 23: No. 2, 76-81(1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (22 Sep 1971).

A solution was found for the theoretical model of N/D dispersion for the low energy particle-resonance scattering amplitude with the dynamical input of the one-particle exchange mechanism. It was found that depending on the two-particle resonance parameters the particle-resonance amplitude can show a resonance behavior, i.e., a three-particle-resonance can be generated. (auth)

7215 INFINITE HELICITY SUMS AND GENERALIZED 0(1.2) EXPANSIONS. Cronstroem, C. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Acta Phys. Slovaca; 23: No. 2, 97-107(1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (22 Sep 1971).

A brief survey of the 0(1.2) expansion formalism for power bounded multiparticle amplitudes is given. It is shown that the occurrence of infinite helicity sums in the formalism does not present any serious convergence problem. The role of the so-called nonsense terms is clarified, and it is shown that these necessarily cancel identical terms in the 0(1.2) integrals. A modified formalism in which the necessary cancellations are built-in explicitly is suggested. (auth)

7216 THEORY OF RELATIVISTIC STRING AND SUPERWAVE EQUATION, 2. Takabayasi, Takehiko ((Nagoya Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 51: No. 2, 571-591(Feb 1974).

Theory of relativistic string in the "geometric" viewpoint is analyzed and its physical interpretation is clarified. This theory is regarded as the singular limiting case of the relativistic string theory in the "realistic" viewpoint treated in a preceding paper [T. Takabayasi, Prog. Theor. Phys. 51 (1974), 262]. If one restricts the internal motion of the realistic string theory to transverse ones alone by a certain physical constraint, both theories are smoothly connected. For this case concrete movements of relativistic string are explicitly displayed. The quantization and the introduction of external interaction are briefly stated to indi-

cate the meaning of relativistic string theory as a model of hadrons leading to dual amplitude. (auth)

7217 SCALING OF MULTIPLICITY DISTRIBUTIONS AND STATISTICAL MECHANICS ANALOGY OF MULTIPARTICLE PRODUCTION. Uematsu, Tsuneo (Kyoto Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 51: No. 3, 882-892(Mar. 1974).

The KNO scaling of multiplicity distributions is interpreted in terms of the particle density in rapidity space. This interpretation motivates an exploitation of the analogy between multiparticle production and statistical mechanics in a one-dimensional system. The "pressure analog" is found to be useful in order to examine the KNO scaling in connection with the various classes of models for multiple production. It is shown that the "pressure" in the scaling case changes its shape from multiperipheral-like to diffraction-like as energy increases with particle density fixed. A phenomenological analysis on "pressure" is also given. (auth)

7218 DESCRIPTION OF INCLUSIVE REACTIONS IN QUARK MODEL. Ezawa, Z. F.; Maharana, J.; Miyazawa, Hironari (Tokyo Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 51: No. 3, 877-881(Mar 1974).

The additive quark model is extended to correlate various inclusive cross sections. A set of relations are obtained including those which relate cross sections in the negative x region with the positive x region, x being the Feynman variable. A selection rule is postulated which leads to further consequences in the fragmentation region. These predictions are in agreement with experimental data on pion production over a wide range of energies. (auth)

7219 TWO-COMPONENT MODELS OF MULTIPLE GENERATION. Dushutin, N. K.; Mal'tsev, V. M. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 4, 798-800(Oct 1974). (In Russian).

It is shown that the behavior of the third and fourth correlation parameters obtained in the two-component models for multiple generation do not agree with data. (auth)

7220 CORRELATIONS IN DOUBLE INCLUSIVE NUCLEAR REACTION. Gornov, M. G.; Ponosov, A. K.; Protasov, V. P.; Sergeev, F. M. (Moscow Engineering-Physics Inst.). Yadern. Fiz.; 20: No. 4, 801-803(Oct 1974). (In Russian).

To identify mechanism of the multiple production in elementary collisions, it is proposed to investigate particle correlations in double inclusive nuclear reactions. Taking the two given reactions as examples, the sensitivity of the method to the method of production of the secondary particles is shown. The result, obtained for the reactions may indicate a resonance nature of the threshold enhancement in the mass spectrum of the $K^0\bar{K}^0$ system. (auth)

7221 POMERON SEGMENT IN THE TACHYONLESS DUAL THEORY. Loktionov, M. V. (Leningrad State Univ.). Yadern. Fiz.; 20: No. 4, 812-818(Oct 1974). (In Russian).

It is shown that in the tachyonless Nevue–Schwarz dual subtheory the pomeron singularities belong to the series of trajectories with leading $\alpha(0) = 2$, $\alpha(0) = 3/4$ and become, in fact, poles if the space-time dimension $D = 10$. There is no tachyon in the series of trajectories with leading $\alpha(0) = 3/4$. The metric of pomeron states is discussed. (auth)

7222 CLUSTER RADIATIVE EMISSION AND STATISTICAL MODELS. Lusanna, L. (Univ., Florence). Nuovo Cim., 24A: No. 3, 309-323(1 Dec 1974).

After reviewing some statistical models of multiple production, a cluster radiative emission picture in configuration space is proposed and, with the aid of an extension of the Gottfried model, the rapidity and mass distributions of clusters are determined. They agree with the independent cluster production model of Pokorski and Van Hove. Some connections with the thermodynamical model and some problems about the mass spectra are discussed. (auth)

7223 RELATIVISTIC POINT REVISITED IN THE LIGHT OF THE STRING MODEL. Casalbuoni, R. (Istituto Nazionale di Fisica Nucleare, Florence); Gomis, J.; Longhi, G. Nuovo Cim. 24A: No. 3, 249-258(1 Dec 1974).

The quantum mechanics of the relativistic material point is discussed in the light of some recent ideas, developed for the study of the interacting string model. In accordance with these ideas the interaction among the particles is introduced in a geometrical way, but it is also shown how to interpret such an interaction as due to an external field. The same considerations are briefly applied to the string model. (auth)

Electromagnetic

7224 (COO-2232B-54) CONNECTION BETWEEN BRANCHING PROCESSES AND SCALE INVARIANT FIELD THEORY FOR e^+e^- ANNIHILATION. Orfanidis, S. J.; Rittenberg, V. (Rockefeller Univ., New York (USA)). 1974. Contract AT(11-1)-2232. 38p. Dep. NTIS $5.00.

Branching-process models for e^+e^- annihilation give the same moment sum rules for the one-particle inclusive spectrum as those obtained in scale-invariant theories. In such models the one-particle inclusive spectrum is computed explicitly at high energies and is shown to be gaussian in a variable which is the analog of rapidity in hadronic reactions. Two-particle correlations, exclusive, and prong cross sections are discussed, and definite predictions are obtained. (auth)

7225 SPECTRAL AND ANGULAR DISTRIBUTION OF BREMSSTRAHLUNG RADIATION PRODUCED BY HIGH ELECTRONS IN A DENSE MEDIUM. Varfolomeev, A. A.; Zhevago, N. K. (Inst. of Atomic Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 3, 890-901(Sep 1974). (In Russian).

The spectral-angular distribution of bremsstrahlung radiation produced by an ultrarelativistic electron in an absorbing medium is considered. It is shown that the medium effects lead to a relative increase of the effective emission angles compared to those predicted by the Bethe–Heitler theory. Analytic expressions of the bremsstrahlung spectral-angular distribution are derived by taking into account multiple scattering with a varying mean square angle, polarization of the medium and absorption of virtual quanta. The effect of the boundary of matter on the spectral and angular distribution of bremsstrahlung radiation emitted into vacuum by a sufficiently thick layer of strongly absorbing matter is investigated. (auth)

7226 NONLINEAR THEORY OF EXCITATION OF ELECTROMAGNETIC WAVES IN A DIELECTRIC MEDIUM BY A NONRELATIVISTIC ELECTRON BEAM. Loladze, Ts. S.; Rukhadze, A. A.; Chogovadze, M. E. (Inst. of Physics, Tbilisi, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 3, 875-880(Sep 1974). (In Russian).

Nonlinear interaction between a low density nonrelativistic monoenergetic electron beam and a transverse monochromatic electromagnetic wave in a medium with a dielectric permeability $\epsilon_0(\omega)$ is investigated. A nonlinear dispersion equation is derived. In the linear approximation for the wave amplitude it leads to beam instability characteristic for the given system. For sufficiently high wave amplitudes, however, the instability is stabilized as a result of slowing down of the electron beam in the transverse wave field. The dispersion equation in this case yields a frequency spectrum which depends on the wave amplitude. The maximal amplitude of a nonlinear stationary wave is estimated; the Poynting vector and the efficiency for transformation of electron beam energy into energy of electromagnetic radiation are found. (auth)

7227 ELECTROMAGNETIC ELASTIC NUCLEON FORM FACTORS IN A RELATIVISTIC QUARK MODEL. Blagojevic, M.; Lalovic, D. (Boris Kidric Inst. of Nuclear Science, Belgrade). Progr. Theor. Phys. (Kyoto); 51: No. 4, 1152-1158(Apr 1974).

A quark model based on the relativistic wave equation is considered. The normalizable wave functions are used in the calculation of the nucleon elastic electromagnetic form factors, with the current defined via minimal coupling. A dipole behavior of the magnetic form factors is obtained, and the neutron electric form factor is different from zero. Due to the choice of the spinor part of the wave function, there are no redundant factors in the calculated form factors. (auth)

7228 RADIATIVE CORRECTIONS TO e^+e^- PAIR PRODUCTION INDUCED BY HIGH ENERGY PHOTONS INCIDENT ON ELECTRONS OR NUCLEI. Vinokurov, E. A.; Kuraev, E. A.; Merenkov, N. P. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 66: No. 6, 1916-1925(Jun 1974). (In Russian).

A radiative correction to the cross section for e^+e^- pair production by high energy photons incident on electrons is obtained in the Weizsäcker–Williams approximation in analytic form. Expressions for the positron spectrum $d\sigma/d\Delta = f(\Delta)$, $\Delta = \epsilon_+/\omega_0$ and photon spectrum $d\sigma/d\beta = F(\beta)$, $\beta = \omega/\omega_0$ arising in the $\gamma e^i \to \gamma e^+ e^- e^i$ process are derived. Here ω_0, ϵ_+ and ω are the energies of the initial photon, positron pair and final photon in the rest frame of the initial electron (positron). Pair production in the field of a nucleus is considered. An expression for $\rho(\Delta) = f(\Delta) - f(1-\Delta)$ which can be verified experimentally is found by exploiting the asymmetry of the positron spectrum relative to the point $\Delta = 1/2$. (auth)

7229 CORRESPONDENCE PRINCIPLE IN THE ELECTRON SELF-ENERGY PROBLEM. Vilenkin, A. V.; Fomin, P. I. (Inst. of Theoretical Physics, Kiev). Zh. Eksp. Teor. Fiz.; 67: No. 1, 12-16(Jul 1974). (In Russian).

It is shown that a correspondence exists between the quantum and classical theories of the self-energy of the electron when $\hbar \to 0$. This result signifies, in particular, that the divergencies

in classical and quantum electrodynamics are of a common nature. The apparent violation of the correspondence principle in the self-energy problem noted in the literature can be ascribed to inadequacy of the usual expansion procedure in terms of the parameter $e^2/\hbar c$ for $\hbar \to 0$. (auth)

7230 TWO PHOTON CORRELATIONS IN SYNCHROTRON RADIATION AS A MEANS OF THE BEAM STUDYING. Shuryak, E. V. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 1, 60-62(Jul 1974). (In Russian).

By employing wavelengths shorter than optical wavelengths in the Brown–Twiss correlation method one can study the spatial structure of the radiation sources in those cases when optical systems cannot be used. An example is presented of measuring the beam size in electron storage rings. (auth)

7231 NECESSARY AND SUFFICIENT CONDITIONS FOR CHERENKOV RADIATION. Zelby, L. W. (Univ. of Oklahoma, Norman). J. Franklin Inst.; 296: No. 6, 461-468(Dec 1973).

It is shown that in the case of charged beams of finite dimensions and/or finite electromagnetic wave-guiding structures, the condition $v > c/n$ is a necessary but not a sufficient condition for generation of Cherenkov radiation. Depending upon the modulation, size and geometry of the beams, and dimensions of the wave-guiding structures, selected lines can be eliminated from the radiation spectrum. Since the lines in the spectrum are size and geometry dependent it is suggested that the analysis of the Cherenkov radiation spectrum may be utilized in the determination of sizes and shapes of charged particles. (auth)

7232 INTRINSIC AND ELECTROMAGNETIC PROPERTIES OF NEUTRINOS. Goldhaber, M. (Brookhaven National Lab., Upton, NY). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 1-4 (1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

Empirical limits for the intrinsic and electromagnetic properties of neutrinos are discussed. (auth)

7233 MULTIHADRON PRODUCTION IN e^+e^- INTERACTIONS. Chinowsky, W. (Univ. of California, Berkeley). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 124-139(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

It is found that e^+e^- annihilations are not good sources of meson resonant states and their properties. The interest in the study of this process is rather in elucidation of the fundamental problem of the structure of the elementary particles than in the pursuit of details of the hadron final state interactions. (JFP)

7234 RADIATIVE WIDTHS AND PRIMAKOFF PRODUCTION. Rosen, J. L. (Northwestern Univ., Evanston, IL). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 322-338(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

The discussion of radiative widths covers vector meson–pseudoscalar meson radiative transitions and the measurement of $\pi^- + \gamma \to \rho^-$. (JFP)

7235 QUATERNION AND OCTONION THEORIES OF WEAK AND ELECTROMAGNETIC INTERACTIONS. Adelson, E. Columbus, OH; Ohio State Univ. (1974). 95p. University Microfilms Order No. 74-24,286.

Thesis (Ph. D.).

Trilinear interactions of quaternion field operators were constructed. The components of the quaternions are assumed to act on the usual Hilbert space state vectors of quantum field theory, where the Hilbert space is defined on the field of complex numbers. The interactions were so constructed that they consisted of products of combinations of the field operator components leading to the quaternion identity. When the interactions were represented by matrix products, quaternion trilinear interactions between two fermion fields and one boson field were found to belong to reducible representations of $SU(2) \times X(1)$. It was possible to show that there exists a transformation matrix U such that the transformed fermion quaternion components are separable into two doublets. The coupling of the two doublets to the boson fields has $SU(2) \times U(1)$ symmetry. These interactions were interpreted to be those of left-handed doublet fields ν_{eL}, e_L^- and $\nu_{\mu L}$, μ_L^- incorporated into a single quaternion. It was also possible to represent the left-handed SU(4) quark fields by a single quaternion. Weinberg's theory of weak and electromagnetic interactions can be interpreted as a quaternion theory, since terms bilinear or quadrilinear in the field operators, as required by Weinberg's theory, can also be constructed in this fashion. Singlet fields of the Weinberg theory, which represent the right-handed particles, are real with respect to the quaternion algebra, so that they may be treated as real numbers. Because of the manner in which muon number conservation was incorporated into the quaternion theory, the muon is massive, but the electron is massless. The extension of this quaternion model to octonions was considered. Within the framework of models considered, it was found that the extension to octonions led to nonconservation of charge. (Diss. Abstr. Int., B)

7236 SUPERGAUGE ALGEBRA AND ELECTROMAGNETIC INTERACTION OF THE DUAL PION MODEL, 1. Konisi, Gaku (Kwansei Gakuin Univ., Nishinomiya, Hyogo (Japan). Dept. of Physics); Matsuda, Satoshi; Nakawaki, Yuji; Saito, Takesi. Progr. Theor. Phys. (Kyoto); 51: No. 3, 893-911(Mar 1974).

The electromagnetic problems of the dual pion model proposed by Neveu and Schwarz. The photon gauge substitution and the supergauge algebra appearing in this model are shown to determine the interaction uniquely. Consequently it is found that the electric charge has only two localization points which are at the ends of the string and that new gauge conditions hold, which are crucial for proving the no-ghost theorem in the theory. Also a proof is given of the photon-gauge invariance of the system, and the conserved dual current is found. Unfortunately one is forced to stay in the on-shell world (i.e., massless photon). (auth)

7237 ELECTROMAGNETIC ELASTIC NUCLEON FORM FACTORS IN A RELATIVISTIC QUARK MODEL. Blagojevic, M.; Lalovic, D. (Institut za Nuklearne Nauke Boris Kidric, Belgrade (Yugoslavia)). Progr. Theor. Phys. (Kyoto); 51: No. 4, 1152-1158(Apr 1974).

A quark model based on the relativistic wave equation is considered. The normalizable wave functions are used in the calculation of the nucleon elastic electromagnetic form factors, with the current defined via minimal coupling. A dipole behavior of the magnetic form factors is obtained, and the neutron electric form factor is different from zero. Due to the choice of the spinor part of the wave function, there are no redundant factors in the calculated form factors. (auth)

7238 DEEP INELASTIC eN AND νN SCATTERING: A UNIFIED DESCRIPTION VIA DUAL REGGE POLES AND SU(3). Duke, D. W. Ames, IA; Iowa State Univ. of Science and Tech. (1974). 29p. University Microfilms Order No. 74-23,732.

Thesis (Ph. D.).

The deep inelastic scattering of electrons and neutrinos off nucleons is studied phenomenologically by means of a model that describes the scattering of weak and electromagnetic currents off nucleons. It is found that one may impose the constraints of Regge behavior, duality, SU(3) symmetry, and current algebra in a model for the structure functions and obtain a very accurate and economical description of the data. This approach demonstrates a remarkable resemblance between the strong interactions of hadrons and their weak and electromagnetic interactions. (Diss. Abstr. Int., B)

7239 MULTIPOLE ANALYSIS OF THE REACTIONS $\gamma N \to N\pi$ IN RESONANCE MODEL WITH ANALYTIC BACKGROUND. Krivets, A. G.; Miroshnichenko, I. L.; Nikiforov, V. I.; Sanin, V. M.; Sorokin, P. V.; Shalatskii, S. V. (Physical-Technical Inst., Kharkov). Yadern. Fiz.; 20: No. 4, 804-811(Oct 1974). (In Russian).

The least-square-method is used for phenomenological analysis of the differential cross sections of the reactions $\gamma N \to N\pi$ in terms of the resonance model with an analytical background. The values of the parameters $\sqrt{\Gamma_{0\lambda}\Gamma_{0\pi}}/\Gamma$ for the resonances $P_{33}(1236)$, $D_{13}(1520)$, $D_{15}(1670)$, $F_{15}(1688)$, $S_{11}(1535)$, $P_{11}(1470)$, $S_{31}(1650)$, $P_{11}'(1780)$ are determined and their sensitivity to the choice of nonresonance amplitude (background) is studied. The multipole background amplitudes with the total momentum up to $5/2$ are estimated for the reactions $\gamma p \to n\pi^+$, $\gamma p \to p\pi^0$, $\gamma n \to p\pi^-$. The isotopic components of the background amplitudes are as well estimated, from the simultaneous consideration of reactions: $\gamma p \to n\pi^+$ and $\gamma p \to p\pi^0$. (auth)

7240 EXPERIMENTAL LIMITS TO THE $\pi^0 \to e^+e^-$ RATE AND THEIR CONSEQUENCES FOR A DIRECT ELECTRON–HADRON COUPLING. Davies, J. D. (Univ. of Birmingham, Eng.); Guy, J. G.; Zia, R. K. P. Nuovo Cim., 24A: No. 3, 324-332 (1 Dec 1974).

It was suggested that the high $\sigma(e^+e^- \to \text{hadrons})$ observed at SPEAR can be explained by electrons having hadronic cores. These could contribute to the decays of pseudoscalar mesons into e^+e^- pairs for which model-independent considerations show that only pseudoscalar and axial vector couplings are possible. From estimates of the decay rates it is demonstrated that the measurement of $B_{\pi^0} = \Gamma(\pi^0 \to e^+e^-)/\Gamma(\pi^0 \to \text{all})$ is a sensitive test. Since no

specific measurement has been reported, the published data are reviewed in order to obtain an upper limit on B_{π^0}. It is found that $B_{\pi^0} < 8.16^{-6}$ at the 90% confidence limit. This severely limits pure pseudoscalar coupling. It is shown that Weinberg-type neutral currents would give a negligible contribution to B. (auth)

Weak

7241 (CERN-74-18) SYMPOSIUM ON ANTINUCLEON-NUCLEON INTERACTIONS, LIBLICE-PRAGUE, 25-28 June 1974. Montanet, L. (ed.). (European Organization for Nuclear Research, Geneva (Switzerland)). 20 Sep 1974. 528p. (CONF-740667-).

The conference included 42 papers. Separate abstracts were prepared for all papers. (JFP)

For abstracts of individual papers see: 7161-7180, 7184-7192, 7206, 7252, 7260-7269, and 7312.

7242 NEUTRINOS: 1974. Conference held in Philadelphia, Pennsylvania, April 26-28, 1974. Baltay, C. (ed.). AIP Conference Proceedings Number 22, Particles and Fields Subseries No. 9. New York; American Institute of Physics (1974). 334p. (CONF-740418-).

The conference included 15 papers. Separate abstracts were prepared for each paper. (JFP)

For abstracts of individual papers see: 7028, 7039, 7055, 7160, 7232, 7243-7250, 7290, and 7311.

7243 NEUTRINO PHYSICS: THEORETICAL CONSIDERATIONS. Lee, B. W. (National Accelerator Lab., Batavia, IL). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 29-55(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

The review of neutrino physics covers kinematics and standard V-A theory, exclusive and inclusive interactions, scaling and the quark parton model, scaling and the light cone, and gauge theories. (JFP)

7244 CHARMED PARTICLE SEARCHES IN NEUTRINO EXPERIMENTS. Gaillard, M. K. (National Accelerator Lab., Batavia, IL). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 65-76(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

The discussion of charmed particle searches in neutrino experiments covers the reason for charm, masses of charmed particles, threshold effects, the production of charmed particles in neutrino experiments, the optimistic assumption $F_x \neq 0$, strangeness-changing events, and a summary of signatures. (JFP)

7245 NEUTRINO CROSS SECTIONS AT VERY HIGH ENERGIES. Zee, A. (Princeton Univ., NJ). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 77-81(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

The implications of asymptotic freedom for neutrino experiments at very high energies are discussed. (auth)

7246 NEUTRINO EXOTICS. Marx, G. (Roland Eoetvoes Univ., Budapest). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 83-92(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

A review is given of the theoretical ideas and observational evidence concerning the possible neutrino instability, neutrino rest mass, and exotic neutrino coupling. (auth)

7247 WEAK ENERGY DIFFERENCE BETWEEN MIRROR MOLECULES. Gajzago, E.; Marx, G. (Roland Eoetvoes Univ., Budapest). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 93-100(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

A review is given of the possibilities, how weak electron-proton force—neutral current coupling—could manifest itself by producing parity impurities in the atomic and molecular spectroscopy. The experimental implications were also discussed in some detail. (auth)

7248 TWO-BODY NEUTRINO REACTIONS: FORM FACTORS. Schreiner, P. A. (Argonne National Lab., IL). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 101-140(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

A review of experiments to measure hadronic form factors in two-body and quasi-two-body neutrino reactions is presented. (auth)

7249 TOTAL AND DIFFERENTIAL CROSS SECTIONS IN DEEP INELASTIC NEUTRINO SCATTERING. Sciulli, F. J. (California Inst. of Tech., Pasadena). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 166-200(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

A short description of the relevant formula with some attemption to the assumptions involved is given for deep inelastic neutrino scattering total and differential cross sections. The existing experimental data are mainly discussed. (JFP)

7250 EXPERIMENTAL SEARCH FOR NEW PARTICLE PRODUCTION IN HIGH ENERGY NEUTRINO INTERACTIONS. Cline, D. B. (Univ. of Wisconsin, Madison). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 201-258(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

Neutrino-nucleon interactions are discussed, including new particles, the kinematics and experimental signature for new particle production, search for new particles in the muon less channel, search for new particles using the single muon channel, and dimuon event signature. (JFP)

7251 INTERACTION OF NEUTRINOS WITH MATTER. Landovitz, L. F. (Yeshiva Univ., New York); Schreiber, W. M. Nuovo Cim., 24A: No. 3, 301-308(1 Dec 1974).

An equation of motion for neutrinos in matter is presented. Solutions are obtained for neutrino motion in uniformly rotating current distributions. Implications for stellar neutrino emission are considered. (auth)

Strong (General)

7252 (CERN-74-18, pp 422-427) STATISTICAL BOOTSTRAP MODEL AND ANNIHILATIONS. Moehring, H. J. (Karl-Marx-Univ., Leipzig). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The statistical bootstrap model describes the decay of single high mass hadronic states (fireballs, clusters) into stable particles. The main results of the model are that all momentum spectra are isotropic and that the model parameter B for pions was obtained by fitting the multiplicity distribution $\bar{p}p$ and $\bar{p}n$ at rest and corresponds to $T_0 = 0.167$ GeV in the full statistical bootstrap model with exotics. (JFP)

7253 (COO-3069-262) QUARK BAG THEORY. Jaffe, R. L.; Johnson, K. (Massachusetts Inst. of Tech., Cambridge (USA)). 1974. 13p. (CONF-740678-1). Dep. NTIS $4.00.

From seminar on quark and parton problems; Moscow, USSR (24 Jun 1974).

A new model of hadrons is constructed in which hadrons are composite and extended, the constituents (quarks) exist only inside, and the constituents are the quanta of massless relativistic fields which can (and will in the first approximation) obey free field equations inside of the extended hadrons. (JFP)

7254 THEORY OF INTERACTING POMERONS AND HADRON REACTIONS AT HIGH ENERGIES. Migdal, A. A.; Polyakov, A. M.; Ter-Mortirosyan, K. A. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 67: No. 3, 848-868(Sep 1974). (In Russian).

The problem of scattering of ultra high energy particles, which reduces to the problem of self-action of pomeron field, is considered within the framework of the Regge diagram technique. The total cross section asymptotic and the elastic diffraction scattering amplitude are calculated by employing methods of strong coupling theory and ϵ expansion. The relation of the solutions obtained to perturbation theory is investigated. The position of the bare pole for small coupling constants is determined. The solutions obtained are scale-invariant with anomalous dimensions in ξ, ρ space, where ξ is the rapidity and ρ the impact parameter. (auth)

7255 THEORETICAL EXAMINATION OF HIGH ENERGY PARTICLE CORRELATION FUNCTIONS. Makarowitz, L. New York; Univ. of New York (1974). 208p. University Microfilms Order No. 74-25,547.

Thesis (Ph. D.).

The theoretical predictions made for various observables (and particularly, the average multiplicity and integrated correlation functions) by several models of high energy hadron-hadron inter-

actions. A specific model is studied for the purpose of fitting the experimental data. Experimental results indicate that the two-body correlation function ($f_2^{(1)}$) is positive at laboratory momenta above about 50 GeV/c. To obtain positive f_2, multiperipheral models modified to include more than one different vertex type with more than one particle emitted at some vertices are examined. It is shown that in such models, $f_2 = c_2 \ln(s) +$ constant at high energy, and c_2 can be positive, s being the square of the center of mass energy of the incident particles. Furthermore, $\langle n \rangle$, the average multiplicity, and all correlation functions f_j go as $c_j \ln(s)$ at high s. As a result, the model features a special form of Koba-Nielsen-Olesen (KNO) scaling. A numerical analysis was made of the model for clusters of up to eight particles emitted at the vertices, and the average multiplicity, the Mueller two-body correlation function, and the Mueller three-body correlation function were calculated. A favorable, though crude, fit to the experimental data was obtained. (Diss. Abstr. Int., B)

7256 SYMMETRIES OF CURRENTS AS SEEN BY HADRONS. Gilman, F. J. (Stanford Univ., CA). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 369-386(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

The transformation properties of hadron states and current operators under the $SU(6)_W$ algebra of currents are reviewed. A transformation from current to constituent quark bases is introduced, and the algebraic properties of certain transformed current operators are abstracted from the free quark model. The resulting theory yields selection rules, relations among widths, and relative signs of amplitudes for both pion and real photon transitions among hadrons. The agreement with experiment found, especially for amplitude signs, lends strong support both to the proposed theory of current-induced-transition amplitudes and to the assignment of hadrons to constituent quark model multiplets. The theory may then be used to classify states and to predict properties of yet unseen decays, thereby providing a new tool in hadron spectroscopy. (auth)

7257 RELATIVISTIC COMPOSITE MODEL CONSISTENT WITH THE BETHE-SALPETER EQUATION, APPROXIMATE SU(6) SYMMETRY AND DUALITY, 1. Machida, Shigeru (Kyoto Univ. (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 51: No. 4, 1159-1171(Apr 1974).

Dual composite theory of many-meson amplitudes is applied to investigation of the Bethe-Salpeter (BS) equation for one-meson states. The interaction kernel is the direct extension to this case of those which were determined by duality for many-meson amplitudes. The BS equation is shown to have solutions with the following properties: (i) There are no second-kind exotic states in the leading Regge trajectories. (ii) Mesons form approximate irreducible representations of $SU(6) \otimes O(3)_L$ and $SU(6)_w \otimes O(2)_{La}$ symmetry at rest and for linearly moving states respectively. (iii) These states may be made exact irreducible representations if one takes an appropriate form of an arbitrary function of total momentum which remains in the BS amplitudes. (iv) Mesons form linearly rising Regge trajectories with respect to the total orbital angular momentum of urbaryons inside the meson. (v) Dependence on relative space-time coordinates of the BS amplitudes is given by the factorized residue functions at the poles of the dual function in the interaction kernel. (vi) BS amplitudes on the leading trajectory have positive norm, whereas there appear negative norm states also on the daughter trajectories when the Veneziano function is chosen as the space-time part of the interaction kernel. Discussion is given on the relations among the constructive and interactive forces and on the duality in the composite theory of hadrons. (auth)

7258 GENERALIZED GAUGE CONDITIONS IN THE VIRASORO-SHAPIRO MODEL AND ELIMINATION OF GHOSTS. Kawati, Syozi; Konisi, Gaku (Kwansei Gakuin Univ., Nishinomiya, Hyogo (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 51: No. 4, 1131-1144(Apr 1974).

A proof for the no-ghost theorem of the Virasoro-Shapiro model is given without referring to the Virasoro conditions $[L_0^+ - L_n^+ - \alpha(0)/2]|\Phi \geq 0$ which do not hold. The crucial point for the proof is that there hold modified gauge conditions $\tilde{L}_n^+|\Phi \geq 0$ ($n = 1,2...$) where $\tilde{L}_n^+$ are the conformal group generators in the interacting case. The whole scheme is constructed based on the closed string loop model. (auth)

7259 PERIPHERAL ORBIT MODEL. Hara, Yasuo; Kuroda, Tomonori; Takaiwa, Yoshinobu (Tokyo Univ. of Education (Japan). Dept. of Physics). Progr. Theor. Phys. (Kyoto); 51: No. 3, 840-858(Mar 1974).

A peripheral orbit model, in which an incoming hadron is assumed to revolve in a peripheral orbit around a target hadron, is proposed. The nondiffractive parts of two-body reaction amplitudes of hadrons are expressed in terms of the radius, width, and absorptivity of the orbit. The radius of the orbit is about 1 fm and the width of the orbit is determined by the range of the interaction between the hadrons. The model provides good approximations for both real and imaginary parts of peripheral reaction amplitudes and successfully reproduces the differential cross sections and polarizations of $K^-p \to K^-p$ and $K^-p \to \bar{K}^0n$ reactions for all energies ($p_{lab} \gtrsim 0.7$ GeV/c), and for all angles. (auth)

Strong (Baryon No. = 0)

Refer also to abstracts 7192 and 7310.

7260 (CERN-74-18, pp 151-161) CLUSTERS IN $\bar{p}p$ ANNIHILATION AND IN pp PIONIZATION. Fields, T. (Argonne National Lab., IL); Singer, R.; Rhines, D.; Whitmore, J. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (26 Jun 1974).

Several comparisons are made of correlations in annihilation with those in multiparticle production in 205-GeV pp collisions. A model is used in which the pionization process is interpreted as the independent emission of several clusters of pions with each cluster having properties similar to the supposed single cluster annihilation of $\bar{p}p$. (JFP)

7261 (CERN-74-18, pp 163-170) NEUTRAL PION PRODUCTION IN $\bar{p}p$ ANNIHILATIONS AT 2.0 GeV/c. Chaudhary, B. S.; Ganguli, S. N.; Gurtu, A.; Malhotra, P. K.; Mehtani, U.; Raghavan, R.; Subramanian, A. (Tate Inst. of Fundamental Research, Bombay). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (26 Jun 1974).

Preliminary results on π^0 production in $\bar{p}p$ interactions at 2 GeV/c are presented. These results include the topological cross sections, inclusive π^0 cross sections, and average π^0 multiplicity are given as a function of charged-particle multiplicity. (JFP)

7262 (CERN-74-18, pp 179-187) FOUR-PION FINAL STATE IN $\bar{p}p$ ANNIHILATIONS AT 5.7 GeV/c. CERN-Prague Collaboration. 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (26 Jun 1974).

A study is presented of the four-pion final state in the reaction $\bar{p}p \to 2\pi^+ 2\pi^-$ at 5.7 GeV/c. The momentum and angular distributions, and ρ^0 and f^0 production with their masses, widths, and fractions are discussed. (JFP)

7263 (CERN-74-18, pp 206-231) HIGH ENERGY INTERACTIONS OF ANTIPROTONS. Simak, V. (Inst. of Physics, Prague). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Some features of the dynamics in $\bar{p}p$ interactions are discussed including annihilation and nonannihilation processes in low and intermediate energy $\bar{p}p$ interactions, multiplicity and single-particle distributions and scaling in high energy $\bar{p}p$ interactions, and $\bar{p}p$ interactions with primary energy above 100 GeV. (JFP)

7264 (CERN-74-18, pp 232-247) THEORY OF NUCLEON-ANTINUCLEON ANNIHILATION. Rubinstein, H. R. (CERN, Geneva). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The discussion of the theory of nucleon - antinucleon annihilation covers low energy annihilation, theoretical duality, and high energy annihilation. (JFP)

7265 (CERN-74-18, pp 288-343) DYNAMICS OF EXCLUSIVE REACTIONS. (Tokyo Metropolitan Univ.). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The review of nucleon - antinucleon interactions covers elastic and charge-exchange interactions at low and higher energies, nonannihilation single and double pion production, twobody annihilation, and three- and multi-body pion annihilation. (JFP)

7266 (CERN-74-18, pp 350-354) $\bar{p}p \to \bar{\Delta}^{++}\Delta^{++}$ AT 5.7 GeV/c. Cvach, J. (Inst. of Physics, Prague). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The amount of resonance production in the channel cross sections and the forward spike in the $d\sigma/dt$ distribution for $t' < -0.06$ GeV^2 are considered for $\bar{p}p \to \Delta^{++}\Delta^{++}$ interactions at 5.7 GeV/c. (JFP)

7267 (CERN-74-18, pp 405-421) PHENOMENOLOGY OF $B\bar{B}$ INTERACTIONS. Miettinen, H. I. (CERN, Geneva). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

Some theoretically interesting problems of baryon–antibaryon interactions in the 10 to 300 GeV/c energy range are discussed. Comparisons are made between data on annihilation and those on nonannihilation processes. Qualitative differences between these two classes of processes are emphasized. The discussion is phenomenological. Theoretical problems are treated only briefly. (JFP)

7268 (CERN-74-18, pp 488-509) INCLUSIVE ANNIHILATION REACTIONS. Muirhead, H. (Univ., Liverpool). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The discussion of inclusive annihilation reactions covers inclusive antiproton reactions, the separation of the annihilation data, and conclusions which can be drawn from annihilations. (JFP)

7269 (CERN-74-18, pp 510-524) SEPARATION OF THE ANNIHILATION FINAL STATES IN $\bar{p}p$ REACTIONS AT 4.6 AND 9.1 GeV/c. Everett, D.; Gregory, P.; Grossman, P. (Univ., Liverpool). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (25 Jun 1974).

The techniques used to attempt a separation of ambiguous annihilation and inelastic events in $\bar{p}p$ reactions at $\bar{p}$ momenta of 4.6 and 9.1 GeV/c are described. The problem is two-stage: first one must separate the charged particle ambiguities. Then some estimate of the contribution of neutral inelastic processes must be made. (JFP)

7270 REVIEW OF NONSTRANGE MESONS. Bowler, M. G. (Univ. of Oxford). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 1-9(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

The present situation in nonstrange meson spectroscopy is briefly reviewed. (auth)

7271 COMMENT ON PAPER OF M. G. BOWLER. Rosenfeld, A. H. (Lawrence Berkeley Lab., Berkeley, CA). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 10-11(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

Two figures are shown as counter examples to a previous suggestion that one can decide whether or not a resonance exists and guess its mass if it exists, by looking at separate plots of the modulus and phase of an amplitude, and in particular, looking for the energy at which the phase passes through 90°, as opposed to looking at an Argand diagram. The Argand plot for the I = 0 S-wave phase shift and two $N\pi$ Argand plots for D_{15} and F_{35}, elasticity, and phase are the counter examples given. (JFP)

7272 MESONS NEAR THRESHHOLD. Binnie, D. M. (Imperial Coll., London). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 12-21(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

A technique is described whereby narrow mesons produced in the reaction $\pi^- + p \rightarrow$ meson + nucleon can be studied within a few MeV of the threshold. A summary is given of recently published results on the η, ω, η', S^* and ϕ, and some new data showing an unexpected behavior of the ω and η' cross sections is presented. (auth)

7273 NEW RESULTS IN $\pi\pi$ SCATTERING. Maenner, W. (Max-Planck-Institut fuer Physik, Munich). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 22-45(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

The $\pi\pi$ phase shifts from threshold to 1.8 GeV $\pi\pi$ mass are presented. A value for the I = 0 S-wave scattering length was obtained and can be compared to other experiments. The ambiguities arising in the phase shifts above 1000 MeV are discussed. The K^+K^- and $\bar{p}p$ distributions suggest the existence of high mass states above the g meson. (auth)

7274 COMMENT ON THE AMPLITUDE ANALYSIS OF A_1-MESON PRODUCTION. Vaughn, M. T. (Northwestern Univ., Boston). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 71-74(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

It is suggested that the decay amplitude for $A_1 - \rho\pi \rightarrow 3\pi$ may have a strong dependence on the c.m. energy ω of the 3-pion system, such that the decay width is a decreasing function of ω in the A_1 region (this is predicted in some chiral Lagrangian models, for example). This can strongly distort the A_1 propagator from a simple Breit-Wigner form, and, together with a decay width for $A_1 \rightarrow \sigma\pi \rightarrow 3\pi$ which is an increasing function of ω, can account qualitatively for the lack of phase variation of the 1^+ S ρ π amplitude in the analyses of Ascoli and collaborators. This effect is in addition to the rescattering (unitarity) corrections suggested by Aaron and Amado, and reported to this conference by Lasinski. (auth)

7275 DIRECT CHANNEL $\bar{N}N$ PHENOMENA. II. Kalogeropoulos, T. E. (Syracuse Univ., NY). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 97-123(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

First, the well established s-channel phenomena are presented and discussed in terms of an overall picture indicated by the behavior of cross sections. Second, the observations at low energies will be presented which clearly demonstrate that the annihilations exhibit many direct narrow s-channel phenomena and many others are indirectly suggested. (auth)

7276 REVIEW OF STRANGE MESONS. Eisner, R. L. (Brookhaven National Lab., Upton, NY). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 140-172(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

A review of strange meson spectroscopy is presented. The problem areas are still the status of the strange members of the two 1^+ nonets as well as the situation in the high mass K^* region. (auth)

7277 SURVEY OF THEORETICAL ANALYSES OF $\pi\pi$ AND πK INTERACTIONS. Nath, P. (Northeastern Univ., Boston). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 192-235(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

The present status of $\pi\pi$ and πK theory and its relation to experiment is examined. The restrictions on scattering amplitudes from axiomatic principles, their consequences for partial waves and applications for $\pi\pi$ phenomenological analyses are given. Field theory models, Pade approximants and calculations using super-propagator methods are discussed. Finally soft pion theorems and hard meson current algebra analyses and unitarization schemes are presented. Comparison of theory to existing data is given. (auth)

7278 MESON SPECTROSCOPY AND THE PHENOMENOLOGY OF HIGH ENERGY COLLISIONS. Quigg, C. (State Univ. of New York, Stony Brook). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 297-320(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

Properties of high energy scattering amplitudes are deduced from recent $\pi\pi$ phase shift analyses. A brief review is given of the duality issues surrounding diffractively produced states. In this context, finite missing mass sum rules are introduced. The triple-Regge expansion is discussed, and its relation to the Chew-Low formula is emphasized. (auth)

7279 WIDTH OF THE NEUTRAL PSEUDOSCALAR MESONS. Gittelman, B. (Cornell Univ., Ithaca, NY). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 339-353(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

A discussion of the status of knowledge of the π^0, η^0, and $X^0(960)$ width is given together with a brief description of recent measurements of these widths by a group at Cornell. (auth)

7280 REVIEW OF SPIN–PARITY ANALYSES OF $\pi\omega$ AND Kω SYSTEMS. Chung, S. U. (Brookhaven National Lab., Upton, NY). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 354-368 (1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

A review is given of the spin–parity analysis of the $\pi\omega$ and

Kω systems. The production and decay properties of these two systems are compared. (JFP)

7281 CHAIRMAN'S COMMENTS: A SURVEY OF THE THEORY CONTRIBUTIONS. Arnowitt, R. L. (Northeastern Univ., Boston). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 396-398 (1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

A brief survey is given of some of the highlights of the theory contributions to the conference. (auth)

7282 DUALITY AND STRONG INTERACTION DYNAMICS. Arik, M. Pittsburgh; Univ. of Pittsburgh (1974). 129p. University Microfilms Order No. 74-24,180.

Thesis (Ph. D.).

The constraints imposed on dual four point functions by conditions of crossing, Regge asymptotic behavior, and polynomial residues are investigated. It is shown that logarithmic Regge trajectories are favored and the most general meromorphic dual amplitude with logarithmic Regge trajectories satisfying the above conditions is constructed and is generalized to N-point functions. A closely related class of nonmeromorphic four point functions with logarithmic Regge trajectories is then discussed. The analyticity structure and the physical picture behind this model are investigated. A fit to proton-antiproton, proton-proton total cross section difference is made and the implications of such a model for strong interaction dynamics is studied. Various representations of the dual model are then derived and their relation to the Veneziano model and its N-point function generalizations is investigated. The operator formulation of the meromorphic class of amplitudes is studied. It is shown that the creation and annihilation operators can be understood in terms of a solvable, relativistic, one-dimensional harmonic oscillator model. The derivation of the operator Hamiltonian in terms of the creation and annihilation operators is then presented. (Diss. Abstr. Int., B)

7283 RIGOROUS BOUNDS ON STRONG INTERACTION COUPLING CONSTANTS. Healy, J. B. New York; Rockefeller Univ. (1973). 77p. University Microfilms Order No. 74-23,778.

Thesis (Ph. D.).

The problem of deriving bounds on strong interaction scattering amplitudes from the results of axiomatic field theory is investigated. The bounds on the $\pi-\pi$ scattering amplitude at points within its analyticity domain which have been obtained by Lukaszuk and Martin are especially interesting because they contain no free parameters, and they impose absolute limits on the size of the renormalized coupling constant for $\pi-\pi$ scattering. The rigorous upper bound derived by Lukaszuk and Martin for the $\pi^0-\pi^0$ scattering amplitude at the symmetric point is proved. The principle new tool is the "parametric dispersion relation" of Auberson and Khuri. Also, for a ϕ^4 type field theory with a scalar bound state which is not too tightly bound, the methods developed by Martin for $\pi-\pi$ scattering are generalized to establish upper and lower bounds on the renormalized coupling constant and an upper bound on the physical coupling constant to the bound state. These new bounds are functions of the mass of the bound state. Numerical examples of the bound on the physical coupling constant are given for several bound state masses. Finally, the relevance of the results to constructive field theory is discussed. It is pointed out that, while the bounds do not apply to a ϕ^4 field theory in 1 space + 1 time dimensions, they do limit the values of the renormalized coupling constant for which one could construct a ϕ^4 field theory in 2 space + 1 time (and, of course, 3 space + 1 time) dimensions. (Diss. Abstr. Int., B)

7284 ON THE VERTEX FUNCTION IN THE STRING MODEL OF HADRONS. Goto, Tetsuo; Naka, Sigefumi (Nihon Univ., Tokyo. Dept. of Physics). Progr. Theor. Phys. (Kyoto); 51: No. 2, 600-612(Feb 1974).

From the viewpoint of the interactive bond which is a kind of interpretation of the quark, the vertex functional is constructed in the string model of mesons. The vertex functional obtained is really symmetric with respect to three strings participating in interactions. As an application of the vertex functional, the scattering amplitude of two strings is calculated in the ground state. (auth)

7285 REVIEW OF THE ETA–ETA' MIXING PROBLEM. Gault, F. D. (Univ. of Durham, Eng.); Jones, H. F.; Scadron, M. D.; Thews, R. L. Nuovo Cim., 24A: No. 3, 259-274(1 Dec 1974).

The consequences of $\eta-\eta'$ mixing in all two-body and three-body meson decays and in high energy charge and hypercharge exchange reactions are probed. (auth)

7286 LOW ENERGY SCATTERING OF MASSIVE PIONS. Volkov, M. K.; Pervushin, V. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 4, 762-774 (Oct 1974). (In Russian).

The scattering amplitude of massive pions is calculated in the theory with a chiral Lagrangian taking into account the loop diagrams. The contributions from baryon loops are as well taken into account. The phase analysis of the scattering amplitude is made. The results obtained by the covariant and noncovariant, with regard to the SU(2) × SU(2) group, methods of calculating the pion superpropagator are compared. The effect of the pion mass on the scattering phases is studied. (auth)

Strong (Baryon No. = 1)

7287 (JINR-P1-8163) ANALYSIS OF THE ρ_0 MESON AND Δ^{++} ISOBAR PRODUCTION FOR THE REACTION $\pi^-p \to p\pi^+\pi^-\pi^-$ IN THE OPER MODEL AT 5 GeV/c. Boreskov, K. G.; Glagolev, V. V.; Lebedev, R. M.; Ponomarev, L. A.; Patochka, I.; Saitov, I. S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1974. 24p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

Using the criteria $|t|_{\pi^+\pi^-} < 0.4$ (GeV/c)^2, $|t|_{p\pi^+} < 0.4$ (GeV/c)^2 and $0.66 < M_{\pi^+\pi^-} < 0.86$, $1.12 < M_{p\pi^+} < 1.34$, the groups of events enriched with those from the channels of quasi-three-body reactions ($\pi^-p \to p\rho^0\pi^-$) and ($\pi^-p \to \Delta^{++}\pi^-\pi^-$), in which ρ-zero meson and delta isobar were produced, were selected from the reaction $\pi^-p \to p\pi^+\pi^-\pi^-$ at 5 GeV/c. For these two groups of events, the $M_{\pi^+\pi^-}$ and $M_{p\pi^+}$ distributions, the polar angle distributions of negative pion and proton in the t-channel coordinate system in the c.m.s. of the corresponding pairs of particles as well as the Trieman–Yang angle distributions are compared to the predictions of the OPER model with the following form factor $F_2 = \exp\{[R_1^2 + \alpha'_\pi \ln(\frac{s}{s_0}\frac{\partial e_1^2}{s_1}\frac{\partial e_2^2}{s_2})](t-\mu^2)\}$. All the distributions were calculated at fixed parameters whose values were determined from the analysis of double-pion production for the reaction $pp \to pp\pi^+\pi^-$. The OPER model gives a correct value of the cross section of the channels considered and describes well the angular distributions. (auth)

7288 (NP-20215) PHASE-SHIFT ANALYSIS OF THE REACTION $\pi^-p \to \Lambda^0K^0$. Baker, R. D. (Science Research Council, Chilton (UK). Rutherford Lab.). Aug 1974. 28p. (RL-74-126). Dep. NTIS (US Sales Only) $5.00.

The technique of Barrelet zeros (Nuovo Cimento; 8A: 331 (1972)) was applied to perform a phase shift analysis of most of the world data on the reaction $\pi^-p \to \Lambda^0K^0$, between threshold and 2200 MeV c.m. energy. The S11(1700) and P11(1780) resonances are definitely present, and P13 and D13 waves also resonate. The F17 wave may be resonating near 2000 MeV. The analysis of Lovelace and Wagner (Nucl. Phys.; B25: 441 (1971)) was checked, and that of Nelson (Univ. of Chicago preprint (1974)) re-done using the present method. No evidence is seen for a cusp in the Nelson data. (auth)

7289 DESCRIPTION OF HIGH ENERGY πN SCATTERING DATA BY THE COMPLEX REGGE POLE MODEL. Dzhgarkava, M. I.; Kazarinov, Yu. M.; Potashnikova, I. K.; Silin, I. N. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz.; 67: No. 3, 839-847(Sep 1974). (In Russian).

Available experimental data on πN elastic scattering and charge exchange are analyzed within the complex Regge pole model. Results of experiments with energies above 10 GeV in the transferred momentum range up to 1 (GeV/c) are employed (altogether 802 experimental points). Statistically satisfactory agreement with the experiments (C.L. ≈ 0.65%) is obtained by taking into account exchange of p, p', ρ and ρ' trajectories. (auth)

7290 NEUTRAL CURRENT INTERACTIONS. Sakurai, J. J. (Univ. of California, Los Angeles). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 57-63(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

Some experimental consequences of the hypothesis that the newly discovered neutral current may be identified with the SU(3) singlet baryon current are discussed. (auth)

7291 TOWARDS EXPERIMENTAL REALIZATION OF BACKWARD SCATTERING FINITE-ENERGY SUM RULES. Cohen, L. K. Ithaca, NY; Cornell Univ. (1974). 249p. University Microfilms Order No. 74-24,275.

Thesis (Ph. D.).

Inasmuch as finite-energy sum rules seem to be a basic addition to the lore of strong interaction theory, it would obviously be desirable to check in lengthy detail just how closely they are

satisfied by an actual experimental system. The objective is to provide exactly this for backward π^+p elastic scattering using the best available theoretical approaches and the most accurate experimental data of recent years. Sum rules for the direct channel only are considered. At every energy from threshold to that corresponding to 14 GeV/c incident pion laboratory momentum and at every relevant scattering angle, a careful comparison is made of the calculated experimental quantities with the actual data. Cutoffs are chosen near 6 GeV/c, about as proper and significant a place as possible for a check of the sum rules. The study is confined within a fixed transfer range from −.10 GeV^2 to +.08 GeV^2. (Diss. Abstr. Int., B)

7292 IMPORTANCE OF FIXED POLES IN REGGE THEORY TO THE ANALYSIS OF RHO MESON PRODUCTION IN PION NUCLEON SCATTERING. Anania, R. M. Lincoln, NE; Univ. of Nebraska (1974). 114p. University Microfilms Order No. 74-23,865.

Thesis (Ph. D.).

The contribution of fixed poles is studied in the Regge analysis of rho meson production from pion-nucleon scattering. A maximum likelihood fit was performed with the aid of the University's computer facility, and four parameters were varied to fit differential cross sections and polarization near the forward direction simultaneously at three different energies. A reasonable fit was possible using a fixed pole hypothesis. (Diss. Abstr. Int., B)

7293 ANALYSIS OF 3-π SYSTEM AND UNITARITY. Ascoli, G.; Wyld, H. W. (Univ. of Illinois, Urbana). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 59-70(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

A re-analysis of the 3-π states produced in $\pi^-p \to \pi^+\pi^-\pi^-p$, using unitarized amplitudes, is presented. (auth)

7294 DECK MODEL REVISITED. Jones, L. M. (Univ. of Illinois, Urbana). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 21, 288-296(1974).

From fourth international conference on experimental meson spectroscopy; Boston, Massachusetts, USA (26 Apr 1974). See CONF-740408-.

Phases between various 3π partial waves in $\pi^-p \to \pi^-\pi^-\pi^+p$ can be understood if the Reggeized Deck effect is used for nonresonant 3π production, and a normal Regge model is used for A_2 production. (auth)

7295 DETERMINATION OF CDD-POLE PARAMETERS IN THE πN $I = J = \frac{1}{2}$ STATE FROM THE REGGE ASYMPTOTIC BEHAVIOUR OF PARTIAL WAVE AMPLITUDES. Brandt, W.; Kaschluhn, F.; Mueller-Preussker, M. (Sektion Physik der Humboldt-Universitaet, Berlin (G.D.R.)). Acta Phys. Slovaca; 23: No. 3, 141-148(1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (16 Oct 1972).

Finite energy sum rules derived from the Regge asymptotics of the partial wave amplitudes were used in determining CDD-pole parameters in the πN $I = J = \frac{1}{2}$ state. In a modified N/D approach an input potential calculated from empirical phase shifts was used. (auth)

7296 VALIDITY OF THE POMERANCHUK THEOREM AND LOW ENERGY DATA FOR THE FORWARD πN SCATTERING AMPLITUDES. Wit, R. (Uniwersytet Jagiellonski, Krakow (Poland). Instytut Fizyki). Acta Phys. Slovaca; 23: No. 4, 203-211(1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (22 Sep 1971).

A short survey of a current numerical analysis of the validity of the Pomeranchuk theorem is given. A sum rule for the inverse amplitude is derived; it holds only if the Pomeranchuk theorem is violated. For the case of πN scattering a numerical analysis of the relation using the dipole model input is presented. (auth)

7297 TWO REGIMES IN HIGH ENERGY COLLISIONS. Soln, J. (Harry Diamond Labs., Washington, DC). Nuovo Cim., 24A: No. 3, 333-352(1 Dec 1974).

Within the framework of the generalized bremsstrahlung model for high energy collisions with charge conservation, the production of charged pions in pp and π^+p collisions is discussed. Comparison with experiments of the integral multiplicity distribution function for charged pions and of the integral correlation parameters for negative pions indicates the existence of lower and higher regimes in high energy collisions. The behavior of the elastic differential cross section in these two energy regimes is also discussed. (auth)

7298 s WAVES OF πN SCATTERING AND MAGNITUDE OF THE SIGMA COMMUTATOR IN THE STATISTICAL MODEL. Gerdt, V. P.; Zhuravlev, V. I.; Meshcheryakov, V. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Yadern. Fiz.; 20: No. 4, 756-761(Oct 1974). (In Russian).

A satisfactory description of the energy dependence of the s phase shifts up to 292 MeV is obtained based on the static model. The s-wave scattering lengths and the magnitude of the σ commutator are calculated. (auth)

7299 INCLUSIVE SPECTRA IN REACTIONS $K^-p \to K^-(\bar{K}^0) + X$ AT 16 AND 35 GeV/c IN INTERPOLATIVE MULTIREGGEON MODEL. Arestov, Yu. I.; Moiseev, A. M.; Babintsev, V. V. (Inst. of High Energy Physics, Serpukhov, USSR). Yadern. Fiz.; 20: No. 4, 782-790(Oct 1974). (In Russian).

A method is presented to calculate inclusive reactions of the type $a + b \to c + X$ and $a + b \to X_1 + c + X_2$ with one and two showers, corresponding to the diffractive processes and central interactions. The method is used to calculate the spectrum in the reaction $K^-p \to K^-(\bar{K}^0) + X$ at 16 and 35 GeV/c. The model in view has no scaling behavior at the considered energies ($s \lesssim 70$). (auth)

7300 PRODUCTION OF NUCLEON ISOBARS BY PROTONS IN THE ONE-POMERON-EXCHANGE MODELS. Konovalenko, A. I.; Kuchin, I. A. (Inst. of High Energy Physics, Serpukhov, USSR). Yadern. Fiz.; 20: No. 4, 791-797(Oct 1974). (In Russian).

A simple parametrization of the semiphenomenological model of the one-pomeron-exchange is proposed. The model describes the most part of the data on nucleon isobar production in pp collisions at several GeV energy. (auth)

7301 ANALYSIS OF THE REACTION $\pi^-p \to \pi^-p\pi^+\pi^-$ AT THE MOMENTUM OF 4.5 GeV/c BY MEANS OF THE REGGE-POLE EXCHANGE MODEL. Beketov, G. V.; Grechko, V. E.; Dement'ev, R. K.; Zombkovskii, S. M.; Kaidalov, A. B.; Konovalov, B. S.; Kruchinin, S. P.; Pozhidaeva, N. A.; Selektor, Ya. M.; Turov, V. F.; Shulyachenko, V. N. (Inst. of Theoretical and Experimental Physics, Moscow). Yadern. Fiz.; 20: No. 4, 717-725(Oct 1974). (In Russian).

The reaction $\pi^-p \to \pi^-p\pi^+\pi^-$ was studied by means of 50-cm and 55-cm hydrogen bubble chambers at the incident pion momentum of 4.5 GeV/c. The obtained experimental results are compared with the calculations based on the Regge-pole exchange model. (auth)

7302 MASS SPLITTING $\Sigma^+ + \Sigma^- - 2\Sigma^0$ AND EXISTENCE OF THE HYPERON $\Lambda^*(1327)$. Molchatskii, L. S. (Kiev Agricultural Inst.). Yadern. Fiz.; 20: No. 4, 734-736(Oct 1974). (In Russian).

The mass difference $\Sigma^+ + \Sigma^- - 2\Sigma^0$ is considered in terms of the bootstrap model of the Σ particle as a bound state of Λ and π. It is shown that for a correct description of the difference one must assume the existence of the $\Lambda^*(1327)$ hyperon with quantum numbers $J^P = \frac{1}{2}^+$. (auth)

7303 P-ODD EFFECTS IN πN SCATTERING AT LOW ENERGIES AND DETERMINATION OF THE ISOTOPIC STRUCTURE OF THE WEAK NONLEPTONIC INTERACTION. Gershtein, S. S.; Folomeshkin, V. N.; Khlopov, M. Yu. (Inst. of High Energy Physics, Serpukhov, USSR). Yadern. Fiz.; 20: No. 4, 737-745 (Oct 1974). (In Russian).

The P-odd effects are considered for the πN scattering with the target polarized along the pion beam and in the opposite direction. The P-odd correlations are enhanced by the interference of the weak and strong interactions (the amplitude at the energies of 100 to 300 MeV is large). Measuring the difference between the πN cross sections at meson factories one may hope to apply in this region the integral method developed by V. M. Lobashev. The P-odd amplitudes are calculated in the soft-pion approximation using the P-odd πNN vertex. The hard-pion effects are taken into account by means of the ρ-meson exchange model. The kinematical analysis shows that the P-odd effects in the backward charge exchange reaction are sensitive to the presence of neutral currents. Study of the P-odd effects in the forward πN scattering (elastic as well as charge exchange) enables one to found the isotopic structure of the weak nonleptonic interaction and, in particular, to test the hypothesis of the enhanced ρ-meson exchange, proposed by G. S. Danilov in order to explain a large circular polarization of the γ quanta from the $np \to d\gamma$ reaction. (auth)

Strong (Baryon No. ≥ 2)

Refer also to abstract 7416.

7304 REGGEON PHENOMENOLOGY IN THE CENTRAL REGION OF THE INCLUSIVE $pp \to \pi^- + X$ REACTIONS. Kobrinskii, M. N.; Likhoded, A. K.; Tolstenkov, A. N. (Inst. of High

Energy Physics, Serpukhov, USSR). Yadern. Fiz.; 20: No. 4, 775-781(Oct 1974). (In Russian).

Reactions $pp \rightarrow \pi^{\pm} + X$ in the central region are investigated in framework of the Regge–Mueller phenomenology. It is shown that with an additional account of the RR terms one may correctly describe the experimental data in a wide range of the total energy and the rapidity, as well as to determine the two-reggeon vertices as functions of the longitudinal mass. An approximate factorization of the mentioned vertices is shown. (auth)

7305 CHARGE TRANSFER IN DIFFRACTIVE EXCITATION MODELS. Low, H. B.; Phua, K. K. (Nanyang Univ., Singapore). Nuovo Cim., 24A: No. 3, 275-284(1 Dec 1974).

The charge transfer distributions and its dispersions in single and double diffractive excitation models were calculated and compared with experimental results of pp collisions at 205 GeV/c. The double diffractive excitation model is closer to the experimental data, but it is emphasized that, on the basis of diffractive excitation models alone, it is impossible to explain the overall charge transfer in multiparticle reactions. (auth)

Particle Invariance Principles and Symmetries

General

7306 MECHANISM OF CHIRAL SYMMETRY BREAKING AND VECTOR MESONS. Natroshvili, K. R. (Tbilisi State Univ., USSR). Soobshch. Akad. Nauk Gruz. SSR; 76: No. 1, 65-68(Oct 1974). (In Russian).

The interacting system of the 0^+ and 1^+ mesons is considered, in which the masses of vector and axial vector mesons are generated spontaneously. A definite mechanism of $SU_3 \otimes SU_3$ chiral symmetry breaking is chosen, and the possibility of adequate description of 0^+ and 1^+ meson mass spectra and the K_{l_3} decay form factors is investigated. (auth)

7307 WAVE FUNCTIONS FOR FREE, MASSLESS PARTICLES AND NONINTEGRABLE REPRESENTATIONS OF SL(2,c). Bracken, A. J. (Univ. of Adelaide, Australia). Phys. Rev., D; 10: No. 4, 1168-1181(15 Aug 1974).

A class of representations of the Lie algebra sl(2,c) is discussed. These representations are operator-irreducible and su(2)-integrable, but are not all integrable to representations of the group SL(2,c). Free, massless fields and wave functions belonging to such index-space representations are considered, and the possible invariant helicities are given in each case. It is shown that the nonintegrability of the sl(2,c) representations does not preclude the possibility of realizing the appropriate unitary representations of the Poincaré group ISL(2,c). This permits the removal of discrepancies between the results of Bender, Frishman et al., and Simon et al. In particular, it is concluded that the free electromagnetic potential, in the radiation gauge, belongs to an infinite-dimensional representation of sl(2,c) which is not integrable. The relations between free, massless fields and wave functions, having the same invariant helicity but belonging to different representations of sl(2,c), are discussed, and the corresponding generalization of a result due to Weinberg is obtained. (auth)

7308 ANALYTICITY IN A SYMMETRY-BREAKING PARAMETER. Fiorentini, G. (Scuola Normale Superiore, Pisa, Italy). Nuovo Cim., 24A: No. 3, 241-248(1 Dec 1974).

Analyticity properties of Green's functions are studied with respect to a parameter ϵ that measures a symmetry breaking in the Hamiltonian. (auth)

7309 CLEBSH–GORDAN COEFFICIENTS FOR THE GROUP O(2,1). Verdiev, I. A.; Kerimov, G. A.; Smorodinskii, Ya. A. (Inst. of Physics, Baku). Yadern. Fiz.; 20: No. 4, 827-838(Oct 1974). (In Russian).

Explicit expression is obtained for the Clebsh–Gordan coefficients of the group O(2,1), and all the properties analoguous to the properties of those for the O(3) group are established. (auth)

7310 O(2,1) GROUP AND DUALITY. Verdiev, I. A. (Inst. of Physics, Baku). Yadern. Fiz.; 20: No. 4, 819-826(Oct 1974). (In Russian).

Following previous work, it is assumed that both the exchanging particles and the external particles (hadrons) are lying on a Regge trajectory, i.e., a totally reggezied amplitude is introduced. Unlike previous work, it is supposed that the one-body reggeon states transform according not to the unitary (the main series) irreducible Lorentz group representation, but to the O(2,1) representation. The integral representation for the totally reggezied amplitude is obtained. This representation is the expansion of the amplitude in generalized Clebsh–Gordan coefficients of the O(2,1) group. In the "pole approximation" the proposed amplitude representation contains a local duality and gives the Veneziano formula in a particular case of spinless external particles. (auth)

Applications (Electromagnetic and Weak)

7311 SYMMETRIES AND CONSERVATION LAWS IN NEUTRINO PHYSICS. Rosen, S. P. (Purdue Univ., West Lafayette, IN). AIP (Amer. Inst. Phys.) Conf. Proc.; No. 22, 5-27(1974).

From 4th international conference on neutrino physics and astrophysics; Philadelphia, Pennsylvania, USA (26 Apr 1974). See CONF-740418-.

The basic conservation laws of neutrino physics are described, and the experimental limits on their validity are discussed. The best limit comes from double beta decay, and it shows that lepton number and helicity are conserved in charged weak current processes to order 3×10^{-4}. No such limits are available for the recently discovered neutral currents, and so the speculation is made that there may be a large breakdown of the usual helicity rule for neutrinos in neutral current interactions. Experiments to test this speculation are suggested in neutrino scattering off various targets, in neutral beta decay, and in pseudoscalar meson decay. The roles of isospin and strangeness in neutral currents are also discussed. Predictions based upon lepton conservation and helicity are made for the decay distributions of heavy leptons. (auth)

Scattering Theory

Refer also to abstracts 7308, 7310, and 7405.

7312 (CERN-74-18, pp 176-178) INTERPRETATION OF THE NEGATIVE CORRELATION OBSERVED BETWEEN THE NUMBERS OF NEUTRAL AND CHARGED PIONS PRODUCED IN $\bar{p}p$ ANNIHILATIONS. Figiel, J. (Inst. of Nuclear Physics, Krakow). 20 Sep 1974.

From international conference on antinucleon-nucleon interactions; Liblice, Czechoslovakia (26 Jun 1974).

It is concluded from the calculations that the dependence of n_0 on n_A for $\bar{p}p$ annihilations can be reasonably well reproduced by a previous model, and that consequently the difference between the n_0–n_A correlations shown can be interpreted as resulting just from the difference between the widths of the prong number distributions for annihilation and nonannihilation processes. (JFP)

7313 OPTIMAL DETERMINATION OF THE SCATTERING AMPLITUDE FROM EXPERIMENTAL DATA. Caprini, I. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 26: No. 3, 317-331(1974). (In Rumanian).

The problem of extracting the scattering amplitude from error-affected experimental data is investigated. A new method, with a better convergence than the usual phase-shift analysis and which is also stable against experimental errors is described. The method is based on the assumption that the physical amplitude is extracted from a space of functions on which a suitable measure of probability is defined. This leads to a modified test for statistical inference. (auth)

7314 GENERAL DERIVATION OF BAECKLUND TRANSFORMATIONS FROM INVERSE SCATTERING PROBLEMS. Chen, H. H. (Inst. for Advanced Study, Princeton, NJ). Contract AT(11-1)-3237. Phys. Rev. Lett.; 33: No. 15, 925-928 (7 Oct 1974).

A general way is demonstrated to derive Baecklund transformations for nonlinear partial differential equations that are solvable by the inverse scattering method in the scheme of Ablowitz, Kaup, Newell, and Segur. (auth)

7315 INSTANTANEOUS ACTION AT A DISTANCE TWO PARTICLE DYNAMICS IN THREE DIMENSIONS. Skelton, H. L. Newark, DE; Univ. of Delaware (1974). 170p. University Microfilms Order No. 74-26,145.

Thesis (Ph. D.).

Instantaneous action-at-a-distance relativistic particle dynamics is investigated for two particles in three dimensions. The differential conditions guaranteeing Lorentz invariance in action-at-a-distance relativistic particle dynamics were first obtained by Currie and by Hill. The two-particle one-dimensional version of these differential conditions was integrated by Hill, who also found the constants of the motion and the particle world lines. An extension is made of this latter work of Hill's to the more general three dimensional problem. An attempt is made to integrate the Lorentz invariance conditions.

The resulting nonlinear partial differential equations, which were solved completely in the one-dimensional case by Hill, are reduced and simplified considerably, but could not be solved completely. Attention is then directed to the constants of the motion and the particle world lines. Use is made of the fact that product of four-vector constants of the motion with the four-vector ($\tilde{K}_{12}$,O) has a simple dependence on the proper times to construct six linearly independent equations. Exploiting the properties of this system of equations, the particle world lines are constructed in terms of the four-vector constants of the motion. (Diss. Abstr. Int., B)

7316 A COMPLETE SET OF FUNCTIONS IN THE QUANTUM MECHANICAL THREE-BODY PROBLEM. Nyiri, J. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Acta Phys. Slovaca; 23: No. 2, 82-90(1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (22 Sep 1971).

A complete set of basis functions for the quantum mechanical three-body problem is chosen in the form of hyperspherical functions. These functions are characterized by quantum numbers corresponding to the chain $O(6) \supset SU(3) \supset O(3)$. Equations are derived to obtain the basis functions in an explicit form. (auth)

7317 DISCONTINUITY OF THE REGGE TRAJECTORY IN THE DUAL RESONANCE MODEL. Kaiser, H. J.; Wieczorek, E. (Institut fuer Hochenenergiephysik der Akademie der Wissenschaften der DDR, Zeuthern); Kaschluhn, F. (Sektion Physik der Humboldt-Universitaet, Berlin (German Democratic Republic)). Acta Phys. Slovaca; 23: No. 2, 91-96(1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (22 Sep 1971).

The discontinuity of the second-order correction for the Regge trajectory is calculated in a dual resonance model. The evaluation is based on planar loop diagrams. In contrast to the behavior of self-energy the correction for the Regge trajectory remains positive in the whole region considered. (auth)

PHYSICS (LOW-TEMPERATURE)

Superconductivity

Refer also to abstracts 5902, 5906, and 6615.

7318 DETERMINATION OF THE ENERGY GAP PARAMETER AND THE ELECTRON–PHONON INTERACTION FUNCTION IN SUPERCONDUCTORS ON BASIS OF TUNNEL DATA. Galkin, A. A.; D'yachenko, A. I.; Svistunov, V. M. (Physical-Technical Inst., Donetsk, USSR). Zh. Eksp. Teor. Fiz.; 66: No. 6, 2262-2268(Jun 1974). (In Russian).

It is shown that the complex energy gap parameter for a strongly-coupled superconductor is directly defined by the tunnel density of states. A linear integral equation of the second kind is obtained for the electron-phonon interaction function without making recourse to the Coulomb pseudopotential or cut-off parameter. The equation is solved for a number of pure metals and alloys. (auth)

7319 EFFECT OF FLUCTUATIONS ON THE TRANSITION TEMPERATURE IN QUASI-ONE-DIMENSIONAL SUPERCONDUCTORS. Efetov, K. B.; Larkin, A. I. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 66: No. 6, 2290-2302 (Jun 1974). (In Russian).

The superconducting transition temperature of quasi-one-dimensional metals depends on the jump probability according to a power law and may be much smaller than that predicted by the BCS theory. The exponent in the formula is calculated for a model with a large number of conducting bands. The relation between the exponent and the form of the correlation function is elucidated for a one-dimensional conductor at zero temperature. (auth)

7320 DIAMAGNETIC FLUCTUATIONS IN LAYER SUPERCONDUCTORS AND SMALL SUPERCONDUCTING PARTICLES. Bulaevskii, L. N. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 66: No. 6, 2212-2220(Jun 1974). (In Russian).

Fluctuations of the diamagnetic moment in impure layer superconductors with Josephson interaction between layers (of the $TaS_2(Py)_{\frac{1}{2}}$ type) are investigated. The fluctuations are of a two-dimensional nature in a not too close vicinity of the transition point. The contribution of thermal fluctuations and zero oscillations of Cooper pairs is evaluated. Above T_c the contribution of zero oscillations, as contrasted to that of thermal fluctuations, decreases with the temperature and field strength very slowly and is still appreciable at temperatures $T \gg T_c$ and field strengths $H \gg H_{c2}(0)$ providing the collision time τ is sufficiently small. The fluctuation moment is calculated for a temperature $T = 0$ and fields $H > H_{c2}(0)$. The moment is determined only by zero oscillations of Cooper pairs. With increase of the field to $H_{c2}(0)$ from above the fluctuation moment grows logarithmically and its decrease with growth of the field above $H_{c2}(0)$ is very slow. Similar results have also been obtained for diamagnetic fluctuations of small superconducting particles. (auth)

7321 SUPERCONDUCTIVITY AND MACROSCOPIC STABILITY CRITERIA FOR ELECTRON–PHONON SYSTEMS. Kulik, I. O. (Physical-Technical Inst. of High Temperatures, Kharkov). Zh. Eksp. Teor. Fiz.; 66: No. 6, 2224-2239(Jun 1974). (In Russian).

The problem of criteria for Cooper instability and structural transitions involving doubling of the lattice constant is investigated within the framework of the electron-phonon superconductivity model. It is shown that the conditions of existence of both types of instability reduce, in the strong screening approximation and for degenerate Fermi systems, to the inequality $\rho s^2 < N^2/\rho_F$ (for an isotropic phonon spectrum). Here ρ is the density, s the velocity of sound (renormalized), N the electron concentration, ρ_F the electron state density at the Fermi surface; the relation between T_c and T_P (Cooper pairing and Peierls doubling temperatures) is determined by the degree of three-dimensionality (magnitude of overlap integral U for neighboring conducting filaments), i.e., by the deviation of the Fermi surface shape from a plane. For a more accurate determination of the criterion it is necessary to take into account logarithmic corrections due to strong coupling, softening of the phonon frequencies near the structural instability point and to three-dimensional interactions. The transition temperatures T_c and T_P are estimated in the electron-phonon interaction model in which deformation and Coulomb interactions are taken into account in a self-consistent manner (generalized "jelly" model or "two-boson" scheme). (auth)

7322 NONLINEAR EFFECTS IN THE ELECTRODYNAMICS OF PURE SUPERCONDUCTORS. Genkin, V. M. (Scientific-Research Radiophysics Inst., Gorky, USSR). Zh. Eksp. Teor. Fiz.; 66: No. 6, 2249-2254(Jun 1974). (In Russian).

Variation of the impedance of pure superconductors of the first kind located in a stationary magnetic field is investigated theoretically for frequencies $\omega \approx 2\Delta$. It is shown that the imaginary part of the impedance, which is determined with an accuracy to the square of the stationary magnetic field strength increases as $\omega \to 2\Delta$. The effect is due to a singularity in the density of states in pure superconductors. (auth)

7323 THEORETICAL INTERPRETATION OF GAP ANISOTROPY IN SUPERCONDUCTING Ga. Wu, I. C. Washington, DC; Georgetown Univ. (1974). 147p. University Microfilms Order No. 74-25,697.

Thesis (Ph. D.).

The striking anisotropy in the superconducting energy gap of single crystal gallium recently reported by Gregory et al., is interpreted in terms of the Markowitz and Kadanoff anisotropy function $a(\vec{K})$. For $a(\vec{K})$, $1 + a(\vec{K}) = |U(\vec{K})|/\langle|U(\vec{K})|\rangle$, is used, where $U(\vec{K}) = \int d^3r \phi^*_{\vec{K}}(\vec{r}) U(\vec{r}) \phi_{\vec{K}}(\vec{r})$ is the diagonal matrix element of electron-ion potential $U(\vec{r})$, $\phi_{\vec{K}}$ is a Bloch function, and $\langle\rangle$ denotes an angular average over the Fermi surface. The matrix element $U(\vec{K})$ is calculated using several approximate Bloch functions and simplified electron-ion pseudopotentials. With the obtained $a(\vec{K})$ functions most of the remarkable features of the gap anisotropy in gallium as shown in Fig. 1 can be explained. As originally suggested by Gregory et al., it is shown that the multiple gaps are a result of the electronic degeneracy being split at the zone boundaries. The anisotropy corresponding to the splitting of the two gaps is estimated to be about 1% in agreement with experiment. The approximate overall angle dependence of the gap in the K_x, K_y plane results naturally from the $\cos \vec{K} \cdot \vec{R}$ terms that occur in a tight binding Bloch function. This is shown to be approximately a $\cos 2\theta_K$ dependence, where θ_K is the angle between $\vec{K}$ and the crystal $\vec{a}$ axis. In addition, a complementary approach to the anisotropy is carried out via the Bogoliubov–de Gennes equations for inhomogeneous superconductors. They are solved in the NFE-two plane wave approximation. Just as in a normal metal, the ratio of the NFE amplitudes of the two plane waves is ±1 at the zone boundaries. This is reflected in the density of states which suggests a two gap model with $I_1(\Delta_1)$ and $I_2(\Delta_2)$ contributing equally to the current. This result has been used to bolster the NFE interpretation of the occurrence of small multiple gaps in the case of gallium. Specifically, we show that the current can be written as $I = \overline{|u_1|^2} I_1(\Delta_1) + \overline{|u_2|^2} I_2(\Delta_2)$, where in the simplest case Δ_1 and Δ_2 are the two NFE gaps $\Delta_0 \pm \Delta(\vec{g})$ and $\overline{|u_1|^2}$ and $\overline{|u_2|^2}$ are average values of the two components of the two plane waves $e^{i\vec{K}\cdot\vec{r}}$ and $e^{i(\vec{K}-\vec{g})\cdot\vec{r}}$. This result serves to justify the method used by Gregory et al., to interpret their I-V data. (Diss. Abstr. Int., B)

PHYSICS (NUCLEAR)

7324 (BARC-770) PROGRESS REPORT ON NUCLEAR DATA ACTIVITIES IN INDIA, X. Balakrishnan, M. (comp.). (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). 1974. 78p. Dep. NTIS (U. S. Sales Only) $7.00.

This report covers work done during the year 1973. Two new research facilities, the 224-cm variable energy cyclotron and the 100-MW thermal research reactor, are briefly described. Work done at twenty-two installations is included. The reports are of typical abstract length. (RWR)

7325 (ORO-4317-41) THEORETICAL STUDIES IN NUCLEAR REACTION AND NUCLEAR STRUCTURE. Progress Report, September 1, 1973–September 1, 1974. Banerjee, M. K.; Griffin, J. J. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). [nd]. Contract AT(40-1)-4317. 41p. Dep. NTIS $5.25.

During this year 31 pieces of research work were produced, and brief reports of these are included in this volume. The work may be divided into the following nine categories: nuclear reactions, nuclear structure, nuclear dynamics, nuclear 3-body problem, nuclear fission, nuclear electromagnetic interaction, nuclear β decay and μ capture, pion–nucleus scattering, and nuclear force. (RWR)

Neutron Interactions with Matter

Refer also to abstracts 7450, 7453, 7454, 7821, and 7830.

7326 (BNL-19179) INELASTIC COHERENT NEUTRON SCATTERING IN AMORPHOUS SOLIDS. Axe, J. D. (Brookhaven National Lab., Upton, N. Y. (USA)). Aug 1974. 25p. (CONF-740718-2). Dep. NTIS $4.25.

From advanced study institute on physics of structurally disordered solids; Kingston, Rhode Island, USA (29 Jul 1974).

Inelastic neutron scattering is widely perceived to be more powerful than optical spectroscopy in investigating the dynamics of crystalline solids because light couples directly only to long wavelength fluctuations which comprise an insignificant fraction of the total, whereas thermal neutrons respond rather uniformly to the entire wavelength spectrum of the lattice excitations. The situation changes substantially if amorphous solids are considered. Single component harmonic solids have well defined long lived normal modes of vibration, or phonons, but since an amorphous solid lacks the translational periodicity of a crystal, these phonons no longer have a single characteristic propagator vector. Since in the amorphous case optical experiments couple not just to long wavelength modes, but instead to long wavelength Fourier components of all normal modes, the relative merits of optical and neutron spectroscopy are reinvestigated. It is found that the principal advantage of neutron spectroscopy lies in the fact that neutrons interact directly with the constituent nuclei rather than indirectly through phonon induced modulation of the optical properties of the material. (SFL)

7327 (KFKI-74-63) MONTE CARLO CALCULATED SPECTRA OF NEUTRONS TRANSMITTED THROUGH AND REFLECTED FROM HOMOGENEOUS WATER SLABS. Palfalvi, J.; Koblinger, L. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Aug 1974. 49p. Dep. NTIS (US Sales Only) $5.50.

Transmission and reflection of 8.5 MeV, 14.5 MeV and fission neutrons are calculated for water shields of thicknesses from 10 to 60 cm. The 48 group spectra are calculated by the Monte Carlo code 05R5S and plotted by the code TRESPASS. Characteristic quantities of the spectra, average energies, thermal and fast fractions, as well as the transmission or reflection probabilities are also given. The Monte Carlo calculated results are compared with results obtained by the albedo code MUSPALB. (auth)

7328 (ORNL-4997) NEUTRON PHYSICS DIVISION PROGRESS REPORT FOR PERIOD ENDING AUGUST 31, 1974. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. 133p. Dep. NTIS $7.60.

This progress report is a compilation of abstracts of reports and journal articles published during the reporting period or presented at scientific meetings during the period. To place the current program in perspective and indicate the relationship of the various papers included, an overview of general areas of research and a summary of specific program activities recently completed or now under way is given. The various areas of research in the division can be viewed as components of a system designed to provide a capability for performing the nuclear analyses that are required in most of the technical programs. These areas include the following: nuclear data measurements, nuclear data calculations and evaluations, nuclear data processing, development of transport methods, integral experiments, sensitivity analyses, nuclear analyses, and information dissemination. The following program activities are described: LMFBR program, GCFR shielding program, CTR program, reactor safety studies, neutron cross-section standards, high-energy accelerator shielding program, NASA program, cancer radiotherapy studies, DNA program, and facility operations. (27 figures, 19 tables) (RWR)

7329 (UCID-15980) TEMPERATURE CORRECTED CROSS SECTIONS. Sutcliffe, W. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Dec 1971. 35p. Dep. NTIS $4.75.

A method for correcting neutron cross sections and transfer matrices is described. In order to calculate reaction rates and flux accurately, the effect of thermal motion of the matter must be taken into account. This is done by use of a single-speed isotropic model. The total cross section, group cross sections, differential cross sections, group transfer matrix elements, conservation, and thermalization are treated. Equilibrium flux distributions computed on the basis of temperature-corrected transfer matrices are presented with the appropriate Maxwell–Boltzmann distributions. (20 figures) (RWR)

7330 (UCRL-51637) CALCULATED NEUTRON EMISSION SPECTRA FROM SPHERICAL SHELLS SURROUNDING A 0- TO 11-MeV NEUTRON SOURCE: TESTS OF THE LLL EVALUATED NUCLEAR DATA LIBRARY (ENDL). Haight, R. C.; Howerton, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 22 Aug 1974. Contract W-7405-eng-48. 12p. Dep. NTIS $4.00.

Calculated neutron emission spectra from spherical shells of various materials surrounding an Am-Be source are compared with published experimental results. The evaluated neutron interaction data used for these calculations were those of the Lawrence Livermore Laboratory Evaluated Nuclear Data Library (ENDL), June, 1974, version. The quality of the comparisons varied from excellent to rather poor. The results for spherical shells of CH_2, Be, and Mo are excellent. For tantalum and tungsten, the comparisons served as diagnostic and resulted in locating an error in the case of tantalum and an inadequacy in the case of tungsten. It is concluded that more microscopic measurements are required for niobium and lead. (auth)

7331 (UCRL-51663) OBSERVED PENETRATION OF 14-MeV NEUTRONS IN VARIOUS MATERIALS. Logan, C. M.; Komoto, T. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Sep 1974. Contract W-7405-Eng-48. 16p. Dep. NTIS $4.00.

Experimentally observed 14-MeV-neutron removal cross sections are presented for 16 materials. At a scattering energy loss of 4 MeV, the effective macroscopic cross section per unit mass (cm^2/g) for a nucleus of mass A is given by $0.25A^{-1.78} + 0.10A^{-0.47}$. Such information provides a simple method for estimating neutron transport in systems driven by thermonuclear neutrons. (18 figures, 2 tables) (auth)

7332 SLOW NEUTRON SPECTRA IN COLD MODERATORS. Inoue, K.; Otoma, N.; Iwasa, H.; Kiyanagi, Y. (Hokkaido Univ., Sapporo). J. Nucl. Sci. Technol. (Tokyo); 11: No. 5, 228-229(May 1974).

Systematic measurements were made of the slow-neutron spectra in four cold moderator materials, methane, ethane, hydrogen, and light-water ice, by using the time-of-flight method with an electron linac pulsed neutron source. Spectra are shown, and the gain factors obtained by cooling the assembly are tabulated. It is concluded that methane should be a suitable cold moderator material for pulsed cold-neutron sources; it is possible to obtain a gain factor of 36 or more at about 15°K for long neutron wave lengths. (1 figure, 1 table) (RWR)

7333 RAY-EFFECT MITIGATION IN DISCRETE-ORDINATE-LIKE EQUATIONS. Briggs, L. L.; Miller, W. F. Jr.; Lewis, E. E. (Northwestern Univ., Evanston, IL). Trans. Amer. Nucl. Soc.; 19: 165(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7334 NUMERICAL SOLUTION OF THE TRANSPORT EQUATION BY COLLOCATION WITH BIVARIATE SPLINES. Finkelstein, L.; Krumbein, A. (Soreq Nuclear Research Center, Yavne, Israel). Trans. Amer. Nucl. Soc.; 19: 166(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7335 BENCHMARK ERROR ANALYSIS PACKAGE FOR ONE-DIMENSIONAL NEUTRON TRANSPORT CALCULATIONS (BEAPAC-IT). Abu-Shumays, I. K. (Westinghouse Electric Corp., West Misslin, PA); Bareiss, E. H.; Derstine, K. L. Trans. Amer. Nucl. Soc.; 19: 166-167(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7336 VARIATIONAL INTERPOLATION: A MULTIPOINT PERTURBATION THEORY FOR SENSITIVITY AND SYNTHESIS STUDIES. Cheng, E. T.; Conn, R. W. (Univ. of Wisconsin, Madison). Trans. Amer. Nucl. Soc.; 19: 172-173(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7337 PRACTICAL NUMERICAL METHOD FOR THE EVALUATION OF EFFECTIVE CROSS SECTIONS FOR MANY INTERFERING RESONANCES. Gur, Y.; Segev, M. (Soreq Nuclear Research Center, Yavne, Israel). Trans. Amer. Nucl. Soc.; 19: 173-174(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7338 UTILIZATION OF INTERACTIVE GRAPHICS AND CONTINUOUS SLOWING DOWN THEORY. Danchak, M.; Becker, M.; Moyer, W. R. (Rensselaer Polytechnic Inst., Troy, NY). Trans. Amer. Nucl. Soc.; 19: 175(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7339 POLYNOMIAL APPROXIMATIONS FOR TIME-DEPENDENT SLOWING DOWN. Kang, S.; Becker, M. (Rensselaer Polytechnic Inst., Troy, NY). Trans. Amer. Nucl. Soc.; 19: 178(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7340 PENETRATION OF POINT-ISOTROPIC FISSION SOURCE NEUTRONS IN INFINITE SODIUM. Morris, E. E. (Univ. of Notre Dame, IN). Trans. Amer. Nucl. Soc.; 19: 444-445(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7341 ANGULAR NEUTRON SPECTRA IN IRON: A POINT MATRIX KERNEL SOLUTION. Chan, T. C. (Fluor Pioneer Co., Chicago); Rohach, A. F. Trans. Amer. Nucl. Soc.; 19: 445-446(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7342 TRANSPORT CALCULATIONS FOR 14-MeV AND FISSION NEUTRON SOURCES IN AIR/GROUND AND AIR/SEA-WATER GEOMETRY. Pace, J. V. (Union Carbide Corp., Oak Ridge, TN); Bartine, D. E. Trans. Amer. Nucl. Soc.; 19: 451-452 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7343 NEUTRON- AND PHOTON-ENERGY-SPECTRUM CALCULATIONS FOR NITROGEN INTEGRAL EXPERIMENTS. Cramer, S. N.; Oblow, E. M. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 471-472(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7344 PRODUCTION AND TESTING OF THE DNA FEW-GROUP CROSS-SECTION LIBRARY. Bartine, D. E. (Oak Ridge National Lab., TN); Mynatt, F. R.; Roussin, R. W.; Knight, J. R.; Wright, R. Q. Trans. Amer. Nucl. Soc.; 19: 472-473(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7345 STORAGE TIME OF ULTRACOLD NEUTRONS. Lenk, R. (Technische Hochschule, Karl-Marx-Stadt, Ger.). Phys. Status Solidi (a); 25: No. 2, K141-K143(16 Oct 1974).

In recent experiments with ultracold neutrons the storage times in closed vessels were shown to be considerably smaller than expected from theory, two orders of magnitude for graphite. An explanation of this effect in the form of a corrected theoretical equation is given here. The new treatment gives the right order of neutron loss under total reflection conditions. It is felt that the essential mechanism in determining the storage time is the neutron–phonon interaction: larger storage times should be realized with materials with smaller inelastic cross sections and/or at lower temperatures. (RWR)

7346 ASSESSMENT OF FAST-REACTOR GROUP CONSTANTS FOR SOME REACTOR MATERIALS THROUGH MEASUREMENTS AND ANALYSES OF ENERGY- AND SPACE-DISTRIBUTIONS OF FAST NEUTRONS IN TEST ASSEMBLIES. Nishihara, Hiroshi; Kimura, Itsuro (Kyoto Univ. (Japan). Faculty of Engineering); Kobayashi, Katsuhei. pp 861-882 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo, Japan; Power Reactor and Nuclear Fuel Development Corp. (1973).

From IAEA conference on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Fast neutron spectra in iron, alumina and thoria have been measured by the neutron time-of-flight method using a linear accelerator as a pulsed neutron source. Along with the time-of-flight (TOF) runs, space distributions of neutrons and X-rays were measured by activation of nickel wires and gold foils. The total length of the flight path was 22.1 m. A bank of three ^{6}Li-glass scintillation counters (NE 912 + EMI 9618 R, 12.7 cm diameter) was mainly used for neutron detection. A liquid scintillation counter (NE 213) and a boron-vaseline counter were also used. A new type high-speed multi-channel time-analyzer with wire-memories has been developed for the fast neutron TOF analyses. The space-, energy- and angular-distributions of neutrons in test assemblies were calculated using the multi-group S_n code "DTF-IV", assuming spherically symmetric geometries. This assumption has been verified by the spherical symmetry observed in spatial distributions of neutron flux. The scattering is assumed to be linearly anisotropic (P_1 approximation). The group constants were mostly taken from the JAERI-FAST SET (J-F) and the ABBN SET (ABBN). Group constants for thorium, which are not included in J-F, have been generated from ENDF/B-2 data (J-M). A new set of group constants for iron (J-E) was also used as input to DTF-IV. This set was generated at JAERI using the exact spectrum by the code ESELEM-IV as the weighting spectrum. (auth)

7347 ENERGY AND SPACE DEPENDENCE OF D + T NEUTRONS IN SMALL SAMPLES OF IRON, ALUMINIUM, AND LUCITE. Ozyol, H.; Barutcugil, E.; Ozmutlu, C. (Ankara Nuclear Arastirma Merkezi (Turkey)). Tech. J., Ankara Nucl. Res. Cent.; 1: No. 1, 3-14(Feb 1974).

The induced activity variations of Cu, Al and In detectors located in r and z directions of small samples of iron, aluminium and lucite having the size of 4 cm. in diameter and 7 cm. in length were measured. On the basis of these activity measurements and the excitation functions of threshold detectors, the relative neutron flux distribution for the energy intervals of 14-12.9 MeV, 12.9-6.0 MeV, 6.0-1.65 MeV and for thermal region was obtained. The semiempirical relationships were derived for the neutron flux distribution in r and z directions. Flux distribution in r direction is found to be represented by cosine function for all energies but the one in z direction by the sum of two exponential functions for energies other than thermal energy and also by cosine function for thermal energy. (INIS)

Nuclear Properties and Reactions, $A \leq 5$

7348 OBSERVATION OF ANTITRITIUM. Vishnevskii, N. K.; Grachev, M. I.; Rykalin, V. I. Yadern. Fiz.; 20: No. 4, 694-708(Oct 1974). (In Russian).

Search for a new antinucleus, $^{3}\bar{H}$, was carried out at the IHEP Proton Synchrotron (Serpukhov). Four $^{3}\bar{H}$ nuclei were detected among $\sim 4.10^{11}$ negative particles with a momentum of 25 GeV/c produced by 70-GeV protons on the internal target at 0°. The $^{3}\bar{H}$-nucleus production cross section is found to be $(1.0 \pm 0.6) \cdot 10^{-35}$ cm^2/sr · (GeV/c) · Al-nucleus. (auth)

7349 γ EMISSION FROM NUCLEI EXCITED BY HIGH ENERGY HADRONS. Manaenkov, S. I. (Moscow State Univ.). Yadern. Fiz.; 20: No. 4, 677-687(Oct 1974). (In Russian).

In framework of the Glauber approach selection rules and symmetry relations are obtained for the amplitudes of excitation of individual levels in even-even nuclei induced by high energy hadrons. The spin effects are taken into account in the first order. Mesons and nucleons were considered as the incident particles. The obtained relations are applied to describe the γ emission from the excited nuclei. The principal possibility to separate contributions from two mechanisms of excitation of levels with anomalous parity is discussed. The first mechanism is related to presence of spin terms in hadron–nucleon amplitudes. The second way of the excitation occurs due to the multiple collisions of the incident hadron with the nucleons in the nucleus, while the particle spins do not play an essential role. (auth)

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstract 7343.

7350 (LBL-2999) α-TRANSFER STUDIES VIA THE (α,^{8}Be) REACTION AT HIGH ENERGIES. Wozniak, G. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 144p. Dep. NTIS $10.25.

Thesis.

The (α,^{8}Be) reaction was investigated on ^{16}O, ^{15}N, ^{14}N, ^{12}C, ^{11}B, and ^{10}B targets at bombarding energies between 63.2 and 72.5 MeV with a ^{8}Be identifier of high detection efficiency. Differential cross sections were measured from $\theta_{c.m.}$ = 20 to 70° for solid targets and over a more restricted range for the nitrogen gas targets. An excitation function of the ^{12}C(α,^{8}Be)^{8}Be reaction at five bombarding energies between 63.2 and 67.3 MeV was obtained which conclusively demonstrated the direct nature of the (α,^{8}Be) reaction at high bombarding energies. This reaction was found to proceed predominantly via a direct α-cluster pickup mechanism and to populate strongly only levels consistent with this mechanism. The angular distributions on spin-0 targets exhibited a strong dependence on the value(s) of L, the angular momentum transfer. Experimental distributions for L = 0 and L = 2 transfers were both oscillatory, but with the latter showing a much larger strength at back angles. The distributions for transitions where more than one L-transfer was allowed were approximately constant in magnitude with little structure. A plane-wave diffraction model was used to analyze the cross section data. This model, which included finite-range and recoil effects, adequately reproduced the L = 0 and L = 2 data from spin-0 targets; however, it failed to describe the shape of the angular distributions for transitions involving more than one L-transfer. The neglect of distortion in these calculations was investigated and found to be unimportant at forward angles ($\theta_{c.m.}$ < 70°). By using the above model, relative α spectroscopic factors were extracted which are in qualitative agreement with those of Kurath. (38 figures, 9 tables) (auth)

7351 DEUTERON INDUCED REACTIONS ON ^{9}Be AT LOW ENERGIES. Friedland, E.; Alberts, H. W.; Van Staden, J. C. (Pretoria Univ. (South Africa). Dept. of Physics). Z. Phys.; 267: No. 2, 97-101(Mar 1974).

7 figs.; 2 tabs.; 12 refs.

Absolute excitation functions and angular distributions have been measured for the reactions ^{9}Be(d,p$_0$), ^{9}Be(d,p$_1$), ^{9}Be(d,t$_0$), ^{9}Be(d,α_0), and ^{9}Be(d,α_1) at energies between 0.6 and 2.7 MeV. Attempts to fit some of the data with DWBA calculations are discussed. (auth)

7352 EFFECT OF THE CORE KNOCK-OUT PROCESS IN THE (α,2α) NUCLEAR REACTION. Kudo, Y. (Osaka City Univ.); Honda, T. Progr. Theor. Phys. (Kyoto); 51: No. 4, 1259-1261 (Apr 1974).

The (α,2α) reaction at intermediate energies is usually treated in the plane-wave impulse approximation (PWIA) by assuming a core-plus-cluster nucleus and a direct knock-out process. Theoretical analyses agree with experiment for such nuclei as ^{6}Li, ^{9}Be, ^{12}C, and ^{16}O, but not for ^{7}Li. The latter reaction is treated here by considering in addition a core knock-out process, in which the incident alpha knocks out a triton and leaves an alpha (originally in the target) behind. It is concluded that the treatment discussed here gives a qualitative explanation of the experimental results, but its absolute magnitude is too small. (2 figures) (RWR)

7353 THREE-ALPHA MODEL OF ^{12}C. Orthogonality Condition Model as an Approximation of Resonating Group Treatment. Horiuchi, H. (Kyoto Univ.). Progr. Theor. Phys. (Kyoto); 51: No. 4, 1266-1268(Apr 1974).

It has been shown that the OCM can reproduce the experimental $\alpha + \alpha$ scattering phase shifts as well as the resonating-group method does. Eigen-energies and reduced-width amplitudes for $\alpha + ^8$Be breakup are shown for the lowest two 0$^+$ states. (2 figures, 1 table) (RWR)

7354 IDENTIFICATION OF THE REACTION MECHANISM BY MEASURING ANGULAR CORRELATIONS. Artemov, K. P.; Gol'dberg, V. Z.; Petrov, I. P.; Rudakov, V. P.; Serikov, I. N.; Timofeev, V. A. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 20: No. 4, 688-693(Oct 1974). (In Russian).

The angular dα correlations in the reaction ^{12}C(^{6}Li, d) ^{16}O(α) ^{12}C are measured for 10.35 (4$^+$), 11.1 (4$^+$) and 14.6 MeV (5$^-$) levels of ^{16}O. The observed difference of the angular correlation functions for the 10.35 and 11.1 MeV levels reflects the difference of the excitation mechanisms of those states. (auth)

Nuclear Properties and Reactions, 20 ≤ A ≤ 38

7355 (CEA-CONF-2634) CASE OF THE RELUCTANT RESONANCES. Kalbach, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). 1973. 9p. (CONF-730997-2). Dep. NTIS (US Sales Only) $4.00.

From 6th summer school on nuclear physics; Mikolajki, Poland (3 Sep 1973).

Resonances corresponding to states in ^{24}Mg at around 20 MeV of excitation were first observed in the ^{12}C + ^{12}C system in 1960. Since then, many studies of these and similar resonances have been carried out, and have investigated different reaction exit channels. However, a completely satisfactory explanation for the resonances has not yet been found. Recent experiments at Saclay in which the ^{23}Na + p and ^{20}Ne + α entrance channels were studied provide new evidence supporting an explanation of these resonances as alpha-cluster states. (5 figures, 2 tables) (auth)

7356 TOTAL CROSS SECTIONS OF REACTIONS INDUCED BY DEUTERONS WITH ENERGY OF 13.6 MeV. Dubar, L. V.; Nemets, O. F.; Slyusarenko, L. L; Tokarevskii, V. V. (Inst. of Nuclear Research, Kiev). Yadern. Fiz.; 20: No. 4, 624-631(Oct 1974). (In Russian).

Experimental total cross sections are presented for reactions induced by deuterons with the energy of 13.6 MeV on nuclei Al, Fe, Ni, ^{60,64}Ni, Co, ^{63,65}Cu, Zn, Ag. The obtained experimental data are compared with the theoretical total cross sections, calculated in the optical nuclear model using the unified and optimal potential parameters, obtained from analysis of the differential cross sections of the elastic deuteron scattering. (auth)

Nuclear Properties and Reactions, 39 ≤ A ≤ 58

Refer also to abstract 7356.

7357 GOLDANSKII-KARYAGIN EFFECT AT MOESSBAUER E2-TRANSITIONS. Gedikli, A.; Winkler, H.; Gerdau, E. (Hamburg Univ. (F. R. Germany). 2. Inst. fuer Experimentalphysik). Z. Phys.; 267: No. 1, 61-70(Mar 1974).

5 figs.; 2 tabs.; 18 refs.

Investigations of anisotropic Debye-Waller factors have been carried out mainly using the M1-transitions of ^{57}Fe and ^{119}Sn. For this case the theory of the Goldanskii-Karyagin effect is well established. Moessbauer studies of electric quadrupole interactions in hafnium and tungsten compounds made it necessary to extend the theory to the more complex case of E2-transitions. As the investigated compounds show a strong axial anisotropy of the electric field gradient, a similar behavior has to be expected in principle for the tensor of the mean-square displacements, which determines the Debye-Waller factor immediately. A fitting procedure taking into account an axial asymmetric Debye-Waller factor is worked out and applied to measurements performed with several complex hafnium and tungsten fluorine compounds. With $NaWO_2F_3$ the quadrupole interactions of ^{182}W, ^{183}W, and ^{184}W have been measured yielding $Q^{5+}(^{183}W)/Q^{2+}(^{182}W) = 0.86(3)$ and $Q^{2+}(^{184}W)/Q^{2+}(^{182}W) = 0.955(3)$. (auth)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstract 7356.

7358 (NP-20218) PROGRESS REPORT, 1973–1974. (Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands)). 1974. 97p. Dep. NTIS (US Sales Only) $8.00.

Although this report from the Institute for Nuclear Physics Research contains some data, they are mostly illustrative; the various items are typically of abstract length. The following subjects are treated: nuclear physics with fast electrons, nuclear reactions, nuclear spectroscopy, theoretical nuclear physics, radiochemistry and nuclear chemistry, technical department, design and construction of MEA (Medium Energy Accelerator), future physics with MEA, some investigations by outside groups, and publications. (RWR)

7359 ELECTRON CAPTURE RATIOS OF FORBIDDEN TRANSITIONS IN THE DECAY OF ^{81g}Kr AND ^{59}Ni. Chew, W. M.

Atlanta; Georgia Inst. of Tech. (1974). 109p. University Microfilms Order No. 74-21,560.

Thesis (Ph. D.).

The L/K electron capture (EC) ratio of ^{81g}Kr was measured to be 0.146 ± 0.005 by utilizing the wall-less, anticoincidence, multiwire proportional counter technique and a reactor-produced, mass-separated ^{81g}Kr source. From this value, the Q_{EC} and log-ft values were determined to be $305^{+0.5}_{-0.3}$ keV and 11.6, respectively, if EC decay is only to the ground state. If there is 4% branching to a reported 276-keV level in ^{81}Br, Q_{EC} becomes $322^{+0.5}_{-0.3}$ keV, from which $(L/K)_g = 0.144 \pm 0.005$, log ft = 11.6 for EC to the ground state, $(L/K)_{276} = 0.213 \pm 0.005$, log ft = 11.4 for 4% feeding to the 276-keV level. In order to be confident of these results, an extensive systematic comparison of experimental and theoretical L/K ratios was made for both first-forbidden nonunique and unique transitions. From this comparison, a $\frac{7}{2}^+$ ground-state assignment for ^{81}Kr was confirmed. By using a recent theoretical method, the ratio of nuclear matrix elements $R = ({}^{V}F^{(1)}_{11} - \sqrt{3/2}\,{}^{A}F^{(0)}_{21})/{}^{V}F^{(0)}_{11})$ was determined to be either $20.50^{+0.5}_{-0.3}$ or $25.22^{+0.5}_{-0.3}$ in the second-forbidden nonunique decay of 8×10^4 y ^{59}Ni. These values of R were obtained from a value of $L_3/K = 0.008 \pm 0.002$, found by subtracting the theoretical ratio $(L_1 + L_2)/K = 0.113$ (based on $Q_{EC} = 1070 \pm 8$ keV) from the total $L/K = 0.121 \pm 0.002$, which was measured with a reactor-produced, doubly mass-separated ^{59}Ni source introduced as gaseous nickelocene, $(C_5H_5)_2$Ni, into a multiwire proportional counter. (Diss. Abstr. Int., B)

7360 A PRECISE DETERMINATION OF THE HALF-LIFE OF THE 690 keV E0 TRANSITION IN ^{72}Ge. Nicaise, W. F.; Waltner, A. W. (North Carolina State Univ., Raleigh (USA). Dept. of Physics). Z. Phys.; 267: No. 2, 83-85(Mar 1974).

2 figs.; 9 refs.

The half-life of the 690 keV level of ^{72}Ge is determined from the interval distribution between the beta particles due to decay to this level and the subsequent conversion electrons due to the E0 transition of this level. A value of strength parameter rho = 0.10 is calculated and this value is compared with those predicted by various nuclear models. (auth)

7361 THE DECAY OF ^{75}Ga TO LEVELS IN ^{75}Ge. Chacko, M. C.; Dorikens-Vanpraet, L.; Dorikens, M. (Ghent Rijksuniversiteit (Belgium). Natuurkundig Lab.). Z. Phys.; 267: No. 5, 359-365(May 1974).

6 figs.; 13 refs.; 4 tabs.

The decay of ^{75}Ga has been investigated with Ge(Li) spectrometers. Energy and intensity determinations for 37 gamma rays have been performed. A level scheme for ^{75}Ge was deduced, where 31 gamma transitions could be placed. Beta branch intensities were estimated from the measured gamma intensities. Spin and parity assignments for most of the levels were made in agreement with reaction and neutron capture studies. Half life of ^{75}Ga was measured to be (130 ± 6) sec and that of the 193.3 keV isomeric state in ^{75}Ge to be (47.7 ± 0.5) sec. (auth)

7362 INTERPRETATION OF ISOMERIC CROSS-SECTION RATIOS FOR (n, 2n) REACTIONS. Eapen, P. K. (United Engineers and Constructors, Philadelphia); Salaita, G. N. Trans. Amer. Nucl. Soc.; 19: 393-394(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7363 NEUTRON TIME-OF-FLIGHT SPECTROSCOPY AND THE REACTION ^{88}Sr(^{3}He,n)^{90}Zr. Day, R. H. Ann Arbor, MI; Univ. of Michigan (1974). 130p. University Microfilms Order No. 74-25,184.

Thesis (Ph. D.).

The construction and operation of a neutron time-of-flight spectrometer in conjunction with The University of Michigan 83-inch cyclotron is described. This includes a study of the internal orbits and changes in the cyclotron geometry to produce beam of the proper intensity, quality and phase width for neutron time-of-flight. A computer code was written to calculate the cyclotron orbits and a gated ion source was constructed to produce beam pulses of the proper duty cycle. In addition the reaction ^{88}Sr(^{3}He,n)^{90}Zr was investigated using this facility at incident ^{3}He energies of 16.86, 20.59, and 25.49 MeV. The ground state and first excited state in ^{90}Zr were seen. An angular distribution of the ground state transition was measured at 20.59 MeV and estimates of the ground state cross section of ^{89}Zr and ^{91}Zr were obtained. (Diss. Abstr. Int., B)

7364 GAMMA SPECTRA OF THE REACTION (n,γ) ON ZINC ISOTOPES. Bogdanov, A. P.; Soroka, A. V. (AN Belorusskoj SSR, Minsk. Inst. Fiziki). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 6, 96-103(1972). (In Byelorussian).

The γ spectra produced by the capture of thermal neutrons by ^{66,64,67,68}Zn were measured with a single crystal spectrometer with Ge(Li) detectors. The energies, intensities, and isotopic assignments of most of the γ lines emitted were determined. On the basis of the data obtained schemes were proposed for the γ transitions of ^{65,67,69,69}Zn. An anticorrelation of the probability of excitation of the lowest p levels in (d,p) and (n,γ) reactions was observed for even-odd Zn isotopes. (tr-auth)

Nuclear Properties and Reactions, 90 ≤ A ≤ 149

Refer also to abstracts 7328, 7344, 7356, 7357, 7362, and 7383.

7365 (COO-3439-1) RESEARCH IN LOW ENERGY NUCLEAR PHYSICS. Final Report. (Princeton Univ., N. J. (USA). Dept. of Physics). Oct 1974. Contract AT(11-1)-3439. 66p. (PUC-468). Dep. NTIS $6.25.

On February 28, 1972, the AEC terminated support for this project. This final report describes the cyclotron laboratory, including some history on low-energy physics at Princeton University, a description of the AVF cyclotron, beam transport system, and scattering chambers. The QDDD Spectrograph is described in detail. Background information on the Isotope Separator, hot target facility, and data acquisition system is also included. A comprehensive publications list (nearly 40 pages) concludes the report. (RWR)

7366 (JAERI-M-5752) EVALUATION OF FISSION PRODUCT NUCLEAR DATA FOR FAST REACTOR. Neutron Cross Sections for 28 Nuclides. (Japanese Nuclear Data Committee, Tokai, Ibaraki). Jul 1974. 147p. (INDC(JAP)-22G; NEANDC(J)-35AL). Dep. NTIS (US Sales Only) $10.50.

Results of neutron cross-section evaluation are presented for 28 fission product nuclides, selected as those of the highest priority for burnup characteristics of the fast breeder reactor. The cross sections considered are total, elastic scattering, inelastic scattering, and capture, in the energy range of 100 eV to 15 MeV. Calculation of the cross sections was performed with the spherical optical model and the statistical theory. The optical potential parameters were determined so as to fit the calculated total cross sections to the experimental region of 75 ≤ A ≤ 150. The potential parameters were further tested and verified through comparison between calculated and experimental values of the elastic scattering cross section, its angular distributions, inelastic scattering cross section, and neutron strength function. Level schemes for 28 nuclides were newly collected and evaluated in this work. The initial input values of average radiation width, $\bar{\Gamma}$, and level spacing, $\bar{D}$, were taken from BNL-325 and Baba's compilation, respectively. The calculated capture cross sections were renormalized to the measured values, when available, mainly by adjusting the parameter $\bar{\Gamma}_\gamma/\bar{D}$. The capture cross sections obtained here were compared with those of Benzi et al. and of Cook. Large discrepancies were found among the evaluated data for nuclides for which experimental data did not exist. For the present evaluations of total, elastic scattering, and inelastic scattering cross sections, the errors of the evaluated values were considered less than 30%, except in the low-energy resonance region. Numerical data on the evaluated cross sections are stored in magnetic tape in accordance with the format of ENDF/B. They are also shown in tabular and graphical forms in the appendix of this report. (108 figures, 36 tables, 160 references) (auth)

7367 (UUIP-866) IMPAC EXPERIMENTS AT THE TANDEM VAN DE GRAAFF ACCELERATOR IN UPPSALA. Johansson, K.; Norlin, L. O. (Uppsala Univ. (Sweden). Fysiska Institutionen). Apr 1974. 40p. Dep. NTIS (U. S. Sales Only) $5.00.

The ion implantation perturbed angular correlation method (IMPAC) is described. Formulas for the excitation probability and for the correlation function are given. The electronics and the scattering chamber used at the tandem van de Graaff accelerator in Uppsala are described. As a test of the apparatus the particle–γ angular correlation of Coulomb-excited ^{110}Pd was measured. The target was ~150 μg/cm^2 ^{110}Pd on Cu. The beam was ~50 nA of 31-MeV $^{16}O^{5+}$. The result was $A_2 = 0.704 \pm 0.015$ and $A_4 = 1.682 \pm 0.031$. The bending of the beam in the stray field of the polarizing magnet was determined at two different oxygen beam energies with $B_0 = 0.37$ T. (auth)

7368 THE DECAY OF ^{85}Sr. Herzog, W.; Grimm, W. (Mainz Univ. (F. R. Germany). Inst. fuer Anorganische Chemie und Kernchemie). Z. Phys.; 266: No. 5, 397-404(Feb 1974). (In German).

4 figs.; 3 tabs.; 23 refs.

The nuclide ^{85}Sr was isolated by chemical separation methods after thermal neutron induced fission of ^{235}U. It's decay properties were investigated employing semiconductor spectrometers and

coincidence techniques. A half-life of 24.4 ± 0.2 sec was found. Out of 29 gamma rays, 25 transitions representing 97% of the observed gamma-ray intensity were placed in a decay scheme comprising 19 excited states of ^{95}Y. (auth)

7369 LEVELS OF ^{95}Tc FROM THE DECAY OF ^{95}Ru. Kraemer, K.; Huber, B. W. (Bochum Univ. (F. R. Germany). Inst. fuer Experimentalphysik). Z. Phys.; 267: No. 2, 117-127(Mar 1974).

5 figs.; 3 tabs.; 34 refs.

The level scheme of ^{95}Tc has been investigated with Ge(Li)-detectors by observing the γ-rays after the decay of 1.65 h ^{95}Ru. The energies and intensities of the γ-transitions were extracted from γ-singles and γγ-coincidence spectra. In the decay of ^{95}Ru 88 γ-transitions were observed; a scheme of ^{95}Tc with 25 levels is proposed into which 86 transitions could be accommodated. Spin and parity assignments were made from log(ft) values and γ-ray branching ratios. The level structure of ^{95}Tc is compared with that of the other odd Tc isotopes. (auth)

7370 THE DECAY OF 3.0 MIN ^{143}Eu AND THE LEVELS OF THE N = 81 ^{143}Sm AND ^{141}Nd NUCLEI. Charvet, A.; Chery, R.; Do Huu Phuoc; Duffait, R. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire). Z. Phys.; 267: No. 5, 355-358(May 1974).

3 figs.; 1 tab.; 8 refs.

The decay of 3.0 min ^{143}Eu has been investigated by means of a Ge(Li) detector. The β^+ spectrum obtained with a Si(Li) spectrometer leads to a Q-value of 5,100 ± 50 keV. For the first time a decay scheme including levels situated at 107.5, 755.0, 1,107.9, 1,537.5 and 1,912.8 keV has been established. The data are compared to those obtained for the neighboring N = 81 ^{141}Nd nucleus. Besides, new experimental measurements indicate that the 1,345.4 keV level in ^{141}Nd has not the odd-parity and would be $^5/_2^+$, $^7/_2^+$. Hence, the $^7/_2^-$ state is situated at 1,967.4 keV. Those data are in reasonable agreement with intermediate coupling calculations. (auth)

7371 LEVELS OF ^{97}Tc FROM THE DECAY OF ^{97}Ru. Huber, B. W.; Kraemer, K. (Bochum Univ. (F. R. Germany). Inst. fuer Experimentalphysik). Z. Phys.; 267: No. 2, 111-116(Mar 1974).

4 figs.; 21 refs.; 2 tabs.

The level scheme of ^{97}Tc has been investigated by observing the γ rays following the decay of 2.9-d ^{97}Ru. γ-singles and γ-coincidence measurements were carried out with Ge(Li)-detectors. The time difference of coincident γ-rays was measured as a third parameter. From the coincidence events, the intensities of γγ-cascades were extracted. The ^{97}Ru decay gives rise to 18 γ-lines which could be fitted into a level scheme of ^{97}Tc consisting of 9 levels. Spin and parity assignments of the levels were made from log(ft) values and γ-ray branching ratios. Discrepancies concerning the energy of the first $^5/_2^-$ state and the existence of a 946-keV level are discussed. (auth)

7372 NUCLEAR ORIENTATION MEASUREMENTS OF THE MAGNETIC DIPOLE MOMENTS OF THE $^{11}/_2^-$ ISOMERIC STATES IN ^{129}Xe, ^{131}Xe and ^{133}Xe. Silverans, R. E.; Coussement, R.; Pattyn, H.; Schoeters, E.; Vanneste, L. (Louvain Univ., Heverlee (Belgium). Inst. voor Kern- en Stralingsfysika). Z. Phys.; 267: No. 2, 145-147(Mar 1974).

3 figs.; 4 refs.; 1 tab.

The low-temperature nuclear orientation technique was used to measure the magnetic moments of ^{129m}Xe, ^{131m}Xe and ^{133m}Xe implanted in iron by isotope separator. The magnitudes of the magnetic dipole moments, extracted from gamma-ray anisotropy measurements are $\mu = -0.80(10)\mu_N$ for ^{129m}Xe, $\mu = -0.80(10)\mu_N$ for ^{131}Xe and $\mu = -0.87(12)\mu_N$ for ^{133}Xe. The results for these $^{11}/_2^-$ isomers agree with theoretical calculations by the spin polarization procedure using wave functions from the pairing-plus-quadrupole model. (auth)

7373 NEUTRON ACTIVATION CROSS-SECTIONS FOR THE EXCITATION OF SOME SHORT LIVED ISOMERIC STATES AT 14 MeV. Reimers, P.; Jost, P. (Bundesanstalt fuer Materialpruefung, Berlin (F. R. Germany)). Z. Naturforsch.; 29B: No. 1/2, 127-128(Jan 1974). (In German).

1 fig.; 3 tabs.; 12 refs.

The cross section for the following (n,n') reactions have been measured: ^{107}Ag(n,n')^{107m}Ag, $T_{½}$ = 44 sec, ^{109}Ag(n,n')^{109m}Ag, $T_{½}$ = 40 sec, ^{197}Au(n,n')^{197m}Au, $T_{½}$ = 7.2 sec. Furthermore, the following cross sections for isomeric excitation after (n,p) reactions could be determined: ^{107}Ag(n,p)^{107m}Pd, ^{109}Ag(n,p)^{109m}Pd. These measurements have been made as it proved to be necessary to determine the three (n,n') cross sections for the nondestructive analysis of gold-silver-copper alloys. (GE)

7374 NUCLEAR SCIENCE RESEARCH REPORT. Hamilton, Ontario; McMaster Univ. (1974). 215p.

This report summarizes the research carried out at McMaster University in the field of Nuclear Science during 1973. The introductory chapter briefly outlines the history of Nuclear Science at the University and describes the Nuclear Reactor and the Tandem Van de Graaff Accelerator around which the programme has developed. The next two chapters present progress reports from the research groups using these facilities under the headings of Nuclear Structure Research and Applications of Nuclear Techniques to Research in Other Fields (i.e. Solid State and Materials Research, Science and Engineering Research, Biological and Medical Research). These progress reports are followed in Chapter 4 by reports from the Superintendent of Reactor Operations and the Director of Accelerator Operations. (auth)

7375 CROSS SECTION RATIO OF THE ^{113}In(γ,γ')^{113m}In AND ^{115}In(γ,γ')^{115m}In REACTIONS INDUCED BY THE SCATTERED γ-RAYS OF ^{60}Co. Fujishiro, M.; Furuta, J. Annu. Rep. Radiat. Center Osaka Prefect.; 14: 51-52(1973).

The cross-section ratio $\bar{\sigma}_9/\bar{\sigma}_5$ of the ^{113}In(γ,γ')^{113m}In and ^{115}In(γ,γ')^{115m}In reactions was measured by using the scattered γ rays of ^{60}Co. The result obtained was 0.87 ± 0.01, which agreed with the value 0.70 ± 0.49 measured with bremsstrahlung by Booth et al. (1 figure, 1 table) (auth)

7376 EXCITATION OF TWO QUASI-PARTICLE 5$^-$ AND 7$^-$ STATES IN THE ^{124,126,128,130}Te(p,t) REACTIONS. Matoba, M. (Kyushu Univ., Fukuoka); Hyakutake, M.; Yagi, K.; Aoki, Y.; Rangacharyulu, C. J. Phys. Soc. Jap.; 36: No. 5, 1486(May 1974).

The existence of low-lying quasi-two-particle 5$^-$ and 7$^-$ states in ^{122}Te, ^{124}Te, ^{126}Te, and ^{128}Te is supported using the (p,t) reactions at 51.9 MeV as a probe. Angular distributions for these states are shown. (JFP)

7377 STUDY OF NUCLEI BY ELECTRON SCATTERING. Torizuka, Yoshiharu; Kojima, Yuzo; Saito, Teijiro; Ito, Kohei; Nakada, Akira (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). Kakuriken Kenkyu Hokoku; 5: No. 2, 1-25(Dec 1972). (In Japanese).

A description is given of giant resonance in ^{90}Zr and ^{208}Pb other than electric dipole giant resonance. A large amount of resonance was observed at the excitation energy of 14 MeV in the electron scattering by ^{90}Zr. Analysis of experimental results was performed by assuming a form, $(d\sigma/d\Omega dE)$quasi-elast. = a(Ex-Eo)$^{1/n}$ for quasi-elastic scattering. A Lorentz type was assumed for E1 and 14 MeV resonances, and X^2 fitting was applied. Level width Γ of the 14 MeV resonance was (4.8 ± 0.6) MeV. Multipolarity of the resonance level was investigated by DWBA method. The 14 MeV resonance seems to be E2 or E0 and of collective character. Three exciting levels were observed in the electron scattering experiment of ^{208}Pd. The levels are at the energy of 0.51, 2.09 and 2.7 MeV. A weak exciting level was seen at about 1.1 MeV. Form factor of the 1.13 MeV (2$^+$) level was explained by assuming the anharmonic vibrator model of mixing one phonon state and two phonon state, and the quadrupole moment obtained from the form factor was in good agreement with the result obtained by the experiment of reorientation effect. Experiment was carried out to study the resonance level in ^{208}Pb other than the E1 resonance. Three levels at 10.1, 10.5 and 11.2 MeV seem to be of E2 character. (JA)

7378 EXPERIMENTS ON CHECKING THE THEORY OF ISOBARIC ANALOG RESONANCES. Guzhovskii, B. Ya.; Zvenigorodskii, A. G.; Trusillo, S. V.; Abramovich, S. N. Yadern. Fiz.; 20: No. 3, 449-460(Sep 1974). (In Russian).

The requirements on the experimental data necessary for the test of various versions of the IAR theory are discussed. The nuclear region 70 < A < 140 is shown to be the best one. The methodical requirements to the experimental set-up are formulated. It is shown that those requirements are satisfied most completely if the excitation functions $\sigma_{pp}(\theta,E)$ and $\sigma_{pn}(E)$ are measured simultaneously near IAR as well as in the nonresonance region. The absolute total cross sections $\sigma_{pn}(E)$ and the differential cross sections $\sigma_{pp}(\theta,E)/\sigma_{Coulomb}$ were obtained for the target nuclei ^{104,106,108,110}Pd in the region of the first IAR. The results were analyzed by means of the theoretical formula for the energy-averaged cross sections using the least-square method. The parameters of the resonances, E_R, Γ, Γ_p, ϕ_c^R, Δ, and δ^2 were determined as well as the optical phase shifts $\delta(J^\pi)$ and the penetrability coefficients $T_p(J^\pi)$. (2 figures, 3 tables) (auth)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 7366 and 7377.

7379 (COO-1672-53) RADIOCHEMICAL INVESTIGATIONS OF NUCLEAR PROPERTIES. Progress Report, October 1973–September 1974. Daly, P. J. (Purdue Univ., Lafayette, Ind. (USA). Dept. of Chemistry). Sep 1974. Contract AT(11-1)-1672. 20p. Dep. NTIS $4.00.

The structure of nuclei in the A = 180 to 200 transitional region was studied. In-beam γ-ray investigations of even-A Hg, Pt, Os using the Purdue tandem accelerator were completed. The most striking discovery was the systematic occurrence of a 5⁻, 7⁻, 9⁻, ... sequence of levels connected by enhanced E2 transitions; a description of this sequence in terms of the coupling of a rotation-aligned $i_{13/2}$ neutron with a low-j neutron is proposed. More extensive investigations of high-spin phenomena in Pt nuclei are in progress using the Michigan State cyclotron, and some preliminary results are reported. Tandem experiments on the structure of ^{191,193,195}Au were also performed, and a complementary study of ^{193m}Hg decay was completed. An unfruitful search for ($h_{11/2}\pi$, $i_{13/2}\nu$) 12⁻ isomers in ^{192}Au, ^{194}Au, and ^{202}Au is described. Studies of the structure of ^{188}Os and ^{190}Os by the combined techniques of radioactive decay and neutron-transfer spectroscopy are also briefly described. (4 figures). (auth)

7380 (COO-3255-6) NUCLEAR SPECTROSCOPY. Annual Progress Report, January 1, 1973–November 30, 1973. Brenner, D. S. (Clark Univ., Worcester, Mass. (USA). Dept. of Chemistry). 1973. Contract AT(11-1)-3255. 13p. Dep. NTIS $4.00.

The nuclear chemistry research program at Clark University is concerned with experimental determination of the energy-level structure of nuclei with permanently deformed ground-state configurations. The work is done by measurement of radioactive decay. Titles of articles and talks are listed. Completed work and work in progress are briefly summarized. (3 figures). (RWR)

7381 (INS-J-147) ORBIT-DEPENDENCE OF $Q_0^2/(g_K - g_R)^2$ IN DEFORMED ODD-MASS RARE-EARTH NUCLEI. Kawakami, H. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). 20 Sep 1974. 26p. Dep. NTIS (US Sales Only) $4.50.

The ratio of the intrinsic quadrupole moment to the gyromagnetic factor is reviewed for deformed odd-mass rare-earth nuclei. It is shown that the value of $Q_0^2/(g_K - g_R)^2$ is larger for the Nilsson states with $\Sigma = -1/2$ than for those with $\Sigma = +1/2$, except for the case of $K = 1/2$ band. This fact is explained by taking into account a cancellation between g_K and g_R. The variation of the value of $Q_0^2/(g_K - g_R)^2$ for states having the same asymptotic quantum numbers is discussed in terms of the band mixing due to the Coriolis interaction and of the deformation dependence of the gyromagnetic factor. (4 figures, 2 tables) (auth)

7382 (JINR-E2-8087) OBLATE–PROLATE TRANSITION IN THE GROUND-STATE ROTATIONAL BAND OF LIGHT MERCURY ISOTOPES. Frauendorf, S.; Pashkevich, V. V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

Transitions from the oblate shape to the prolate one in the rotational bands of even-mass mercury isotopes and in the ground states of odd-mass isotopes are studied. These transitions are shown to occur in agreement with the available experimental data. (3 figures, 3 tables) (auth)

7383 (JINR-P6-8030) NEW ISOTOPE ^{148}Dy. Study of the Decay of ^{148,150,152}Dy. Gromov, K. Ya.; Zuber, K.; Zuber, J.; Latuszynski, A.; Penev, I.; Potempa, A. V.; Zelinski, A.; Zuk, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 16p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The new isotope ^{148}Dy was found. The internal conversion electrons and gamma-ray spectra following the decay of ^{148,150,152}Dy were investigated. Decay schemes for these isotopes were proposed. (3 figures, 1 table) (auth)

7384 (JINR-P6-8154) IDENTIFICATION OF THE ^{156}Er ISOTOPE. Aleksandrov, A. A.; Baier, G. Yu.; Vylov, Ts. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 19p. (In Russian). Dep. NTIS (U. S. Sales Only) $4.00.

The isotope ^{156}Er and M3 isomer ^{156}Ho were identified. A new phenomenon in β decay was discovered: a strong enhancement of once-forbidden transitions of the type $0^+ \rightarrow 1^-$. (7 figures, 2 tables) (tr-auth)

7385 INTERNAL CONVERSION COEFFICIENT OF THE 113.8 keV TRANSITION IN ^{175}Lu. Constantinescu, F.; Enulescu, A.; Gelberg, A.; Piticu, I.; Protop, C.; Vata, I. (Institutul de Fizica Atomica, Bucharest (Romania)). Z. Phys.; 267: No. 5, 389-391(May 1974).

2 figs.; 2 tabs.; 18 refs.

The work contains the α_K internal conversion coefficient measurement by XPG method of 113.8 keV transition in ^{175}Lu. We obtained $\alpha_K = 1.82 \pm 0.15$. The 113.8 keV transition in ^{175}Lu supports a large penetration effect, as can be seen from computed λ parameter values. (auth)

7386 POSSIBLE NUCLEAR STRUCTURE EFFECTS IN EVEN-EVEN OSMIUM NUCLEI. Bashandy, E.; El-Nesr, M. S. (Atomic Energy Establishment, Cairo (Egypt). Nuclear Physics Dept.). Z. Naturforsch., 29A: No. 8, 1125-1130(Aug 1974).

5 figs.; 1 tab.; 17 refs.

A compilation of the multipole mixing of $2'+ \rightarrow 2+$ transitions in ^{186}Os, ^{188}Os, ^{190}Os and ^{192}Os is given. In view of recent results obtained at our laboratory, indicating large anomalies in the conversion process of inhibited M1 transitions, the study has been extended for even-even osmium nuclei. A series of experiments has been performed in which the conversion coefficients and transition probabilities were measured. The data of $2'+ \rightarrow 2+$ transitions were analyzed by taking into account nuclear structure effects on the M1 internal conversion process. The M1 admixtures obtained are compared with Greiner's calculations. Values of reduced transition probabilities B(E2, $0 \rightarrow 2+$), B(E2, $2'+ \rightarrow 2+$), the E2/M1 mixing ratio and the transition branching ratio $T(2' \rightarrow 2)/T(2' \rightarrow 0)$ are reported for second and higher 2+ states. The results are compared to the pairing-plus-quadrupole model calculations of Kumar and Baranger. (auth)

7387 ELECTROMAGNETIC TRANSITIONS IN ^{177}Hf. El-Nesr, M. S.; Bashandy, E.; Mousa, M. G. (Atomic Energy Establishment, Cairo (Egypt). Nuclear Physics Dept.). Z. Naturforsch., 29A: No. 4, 593-601(Apr 1974).

8 figs.; 42 refs.; 3 tabs.

The γ transitions in ^{177}Hf have been measured using a 50 cm radius iron-free double focusing β-ray spectrometer. The decay scheme is investigated and the K-conversion coefficients of the 208 and 321 keV transitions have been determined. Comparison with theoretical conversion coefficients for pure E1 radiation calculated by Sliv and Band indicates that the K-conversion process of the 208-keV transition is normal while the large anomaly observed in the K-conversion process of the 321-keV E1 transition is compatible with a large M2 admixture or more probable with the presence of penetration matrix elements. From comparison with theoretical conversion coefficients the 113 keV M1 + E2 transition has been found to be (95.12 ± 0.6)% E2 corresponding to $|\delta| = 4.38 \pm 0.33$. The decay scheme of ^{177}Lu is discussed in terms of nuclear models. (auth)

7388 CAPTURE CROSS SECTION AND RESONANCE PARAMETERS OF ^{169}Tm. Arbo, J. C.; Felvinci, J. P.; Melkonian, E.; Havens, W. W. Jr. (Columbia Univ., New York). Trans. Amer. Nucl. Soc.; 19: 394-395(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 7362, 7373, 7377, 7379, 7386, 7396, and 7399.

7389 (JINR-E-7-8060) J-FORBIDDEN ISOMERIC TRANSITION IN ^{204}At. Gippner, P.; Kaun, K. H.; Neubert, W.; Schulze, W.; Stary, F. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 16p. Dep. NTIS (U. S. Sales Only) $4.00.

An isomeric 587.3-keV transition was investigated by using several target–ion combinations: ^{197}Au + ^{12}C, ^{193}Ir + ^{16}O and ^{196}Pt + ^{15}N. From the measured excitation functions for the ^{193}Ir (^{16}O, xn)$^{209-x}$At reaction it follows that this transition belongs to ^{204}At. The isomeric level is ascribed to the 10^- state of the configuration $\pi(h_{9/2})^2_9 - \nu(i_{13/2})^{-1}$. (5 figures) (auth)

7390 INTERNAL CONVERSION COEFFICIENTS AND PENETRATION EFFECT FOR THE 279 keV TRANSITION IN ^{203}Tl. Hansen, H. H.; Mouchel, D. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements). Z. Phys.; 267: No. 5, 371-377(May 1974).

1 fig.; 4 tabs.; 62 refs.

The internal conversion process of the M1 + E2 mixed 279 keV γ-ray transition in the decay of ^{203}Hg has been reinvestigated. The emission rate of the K-shell internal conversion electrons was determined with an electron X-ray coincidence measurement using a magnetic β-spectrometer and a Si(Li) detector of high energy resolution. Conversion electron ratios were obtained from electron

spectra recorded as a function of momentum. The disintegration rate has been taken from measurements with a calibrated NaI(Tl) γ-ray spectrometer. Following results have been deduced: α = 0.2279 ± 0.0024, α_K = 0.1653 ± 0.0017, α_L = 0.0475 ± 0.0013, K/L + M + ...) = 2.64 ± 0.03, K/L = 3.48 ± 0.12, L/(M + N + ...) = 3.14 ± 0.12. On the basis of the experimental results on the K-shell internal conversion coefficient, α_K, and the conversion ratio K/(L + M + ...) the penetration effect on the internal conversion of the M1 part and the mixing ratio, δ^2, of the 279 keV γ-ray transition in ^{203}Tl have been studied. Calculations were made using Hager and Seltzer's formalism and their theoretical internal conversion coefficients. The results are consistent with a mixing ratio of δ^2 = 1.32 ± 0.11 and a penetration parameter of λ = 6.8 ± 0.8. (auth)

7391 DETERMINATION OF THE PENETRATION PARAMETER OF THE INTERNAL CONVERSION AND OF THE E2 ADMIXTURE FOR M1 TRANSITIONS IN ^{201}Tl AND ^{203}Tl. Hanser, A. (Kernforschungszentrum Karlsruhe (F. R. Germany). Zyklotronlaboratorium). Z. Phys.; 267: No. 2, 135-143(Mar 1974). (In German).

4 figs.; 6 tabs.; 34 refs.

Conversion coefficients and conversion ratios of some γ-transitions in ^{201}Tl and ^{203}Tl were measured by means of simultaneous spectroscopy of γ-quanta and conversion electrons employing intensity calibrated semiconductor detectors. The experiments were aimed at reaching a precision as high as possible within the limits of the experimental method used. The γ-transitions were of the type M1 (+ E2). From the measured values the penetration parameters of the internal conversion for the M1 components (λ) together with the multipole mixing ratios (δ^2) were deduced. The necessary theoretical coefficients were taken from the tables of Hager and Seltzer. The results are for the l-forbidden 331 keV transition in ^{201}Tl, λ = + 4.0 ± 1.0, δ^2 = 1.78 ± 0.16; for the l-allowed 361 keV transition in ^{201}Tl, λ = + 0.5 ± 0.5, δ^2 = 0.02 ± 0.02; for the l-forbidden 279 keV transition in ^{203}Tl, λ = + 5.71 ± 0.45, δ^2 = 1.55 ± 0.08. (auth)

7392 EXCITATION FUNCTIONS OF REACTIONS OF α PARTICLES WITH ENERGIES BETWEEN 40 AND 100 MeV ON ^{209}Bi. Deconninck, G.; Longree, M. (Univ., Louvain, Belg.). Ann. Soc. Sci. Brux. Ser. I; 88: No. 3, 341-346(1974). (In French).

The cross section for ^{209}Bi(α,xn) = 2,3,4,5,6,7,8 and ^{209}Bi(α,pxn), x = 2,4,6 was measured between 40 and 100 MeV. The results agree with the compound nucleus model in the energy region of high cross section (10 MeV above the threshold). A tail in the high energy region is assessed to direct interaction. (auth)

7393 DECAY OF MILLISECOND ISOMERS ^{204m}Bi AND ^{206m}Bi. Rakivnenko, Yu. N.; Klyucharev, A. P.; Lutsik, V. A.; Romanii, I. A.; Skakun, E. A.; Yatsenko, G. I. (Physical-Technical Inst., Kharkov). Yadern. Fiz.; 20: No. 4, 617-623(Oct 1974). (In Russian).

In reactions ^{203}Tl(α, 3n) ^{204}Bi and ^{205}Tl(α, 3n) ^{206}Bi the following quantities were studied: spectra of delayed internal conversion electrons, half-life periods ($T_{\frac{1}{2}}$) characterizing the decrease of intensity of the conversion lines, excitation functions for nuclear reactions resulting in the isomer nuclei ^{204m}Bi ($T_{\frac{1}{2}}$ = 13.0 ± 0.1 msec) and ^{206m}Bi ($T_{\frac{1}{2}}$ = 0.89 ± 0.01 msec). The multipolarities of the delayed transitions are determined comparing the experimental ratios K/L and K/(L + M) with the theoretical values. The obtained data allowed the construction of the decay schemes for the isomer states of odd-odd nuclei ^{204}Bi and ^{206}Bi with the quantum numbers $J^\pi = 10^-$ and to ascribe a two-quasiparticle configuration $\{p\,(h_{\frac{9}{2}})\ n\,(i_{\frac{13}{2}})^{-1}\}$ to these states. (auth)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 6036, 6037, 7337, and 7594.

7394 (BNL-tr-574) EFFECT OF NUCLEONIC STRUCTURE OF FISSIONABLE NUCLEI ON THE AVERAGE KINETIC ENERGY OF FISSION FRAGMENTS. Vorob'eva, V. G.; D'yachenko, N. P.; Kolosov, N. P.; Kuz'minov, B. D.; Sergachev, A. I. Translated by S. J. Amoretty from Yadern. Fiz.; 19: No. 5, 954-958(1974). 13p. Dep. NTIS $4.00.

The mean kinetic energy of fragments from the fission of uranium and plutonium isotopes was measured relative to the general unit, i.e., the mean kinetic energy of fragments from thermal fission of ^{235}U. The results are discussed under the assumption of a Coulomb nature for the kinetic energy of the fragments. There are also given the results of measuring the dependence of the mean fragments kinetic energy for ^{238}U, ^{241,242}Pu upon the energy of neutrons inducing the fission. The difference of those dependences for U and Pu isotopes is pointed out. (4 figures, 1 table) (auth)

7395 (JINR-D7-8194) EXPERIMENTS ON THE PRODUCTION OF FERMIUM NEUTRON-DEFICIENT ISOTOPES AND NEW POSSIBILITIES OF SYNTHESIZING ELEMENTS WITH Z > 100. Oganessian, Yu. Ts.; Iljinov, A. S.; Demin, A. G.; Tretyakova, S. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 28p. Dep. NTIS (US Sales Only) $4.50.

Experimental results and calculations are presented on the production of the neutron-deficient isotopes ^{244}Fm and ^{248}Fm, formed in nuclear reactions of accelerated ^{40}Ar and ^{37}Cl ions with isotopes of Pb and Bi. Cross sections for the (^{40}Ar,xn) reaction with x = 1, 2, 3, 4 were measured for various Pb isotopes. It is shown that if the "magic" nucleus ^{206}Pb or one of its neighbors is used as target and bombarded by ions with mass ≥40 a.m.u., the compound nuclei appear weakly excited and decay to the ground state by emission of 2 or 3 neutrons. New possibilities for the synthesis of elements with atomic number Z > 100 are discussed in the light of the data obtained. (6 figures, 1 table) (tr-auth)

7396 (JINR-D7-8224) EXPERIMENTS ON THE SYNTHESIS OF NEUTRON-DEFICIENT KURCHATOVIUM ISOTOPES IN REACTIONS INDUCED BY ^{50}Ti IONS. Oganessian, Yu. Ts.; Demin, A. G.; Iljinov, A. S.; Tretyakova, S. P.; Pleve, A. A.; Penionzhkevich, Yu. E.; Ivanov, M. P.; Tretyakov, Yu. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 32p. Dep. NTIS (US Sales Only) $4.75.

By bombarding Pb isotopes with ^{50}Ti ions, two new isotopes of element 104 (kurchatovium) with mass numbers 255 and 256 were synthesized. These isotopes were produced in the reactions ^{207,208}Pb(^{50}Ti,2n), and have half-lives of several seconds and about 5 ms, respectively. The experimental results obtained substantially change the understanding of the stability of heavy nuclei with respect to spontaneous fission. The possibilities of synthesizing elements with Z ≥ 106 are investigated. (9 figures, 1 table) (auth)

7397 (JINR-E15-8134) FISSION OF ^{232}Th, ^{238}U, AND ^{235}U INDUCED BY NEGATIVE MUONS. Chultem, D.; Cojocaru, V.; Ganzorig, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1974. 28p. Dep. NTIS (US Sales Only) $4.50.

The absolute yields of prompt and delayed fission induced by negative muons in ^{232}Th, ^{238}U, and ^{235}U were measured. The yields of delayed fission are much lower than could be predicted from Γ_n/Γ_f systematics for 15 to 20 MeV nuclear excitation. The systematics of prompt fission yields is compared with photofission data recently obtained. It is suggested that prompt fission can be used for investigating the channel structure of the fission barrier. (7 figures, 5 tables) (auth)

7398 (JINR-P7-8135) SEARCH FOR TRACES OF HEAVY AND SUPERHEAVY ELEMENTS IN METEORITES. Flerov, G. N.; Otgonsuren, O.; Perelygin, V. P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1974. 21p. (In Russian). Dep. NTIS (US Sales Only) $4.25.

The results of experiments on revealing and identifying the tracks of very heavy cosmic nuclei in olivines from pallasite meteorites are presented. In the Marjalahti meteorite, whose cosmic age is 180 million years, the density of the Fe group tracks reaches (5 to 6) × 10^6 l/cm^2. By taking into account reductions from 13 or 14 cm to 8 μm in the tracks of the Fe group nuclei under space conditions, it is shown that these tracks are located up to 5 to 6 cm deep from the preatmospheric surface of the meteorite. For sensitivity calibration these olivines were bombarded by 5 to 6 MeV/nucleon Ti, Cr, Fe, Zn, Ge, Kr, and Xe ions, and the thermal fading of artificial tracks was investigated. The effect of thermal fading does not seem to reduce the tracks of very heavy cosmic nuclei (Z > 36) considerably. Measurements were carried out by using very long tracks (R > 360 μm) in 40 mm^3 of minerals from the Marjalahti meteorite. If one assumes the group of tracks longer than 580 μm to be due to nuclei of the region from Th to U, their abundance with respect to Fe is 6 × 10^{-7} per one Fe nucleus with the fragmentation and retardation processes is taken into account. The abundance of nuclei with 70 ≤ Z ≤ 83 (R = 360 to 560 μm) appears to be (2.5 ± 0.8) × 10^{-6} per one Fe nucleus. This agrees well with the available results. It is not excluded that only three tracks longer than 800 μm are due to cosmic nuclei ranging from Th to U. In this case their relative intensity (at an energy of 2.5 GeV/nucleon) is nearly 10 to 20 times less than that in previous experiments. The analysis shows that the search and identification of the tracks of superheavy cosmic nuclei should be carried out by using crystals located up

to 1 or 2 cm from the preatmospheric surface of meteorites. (auth) (7 figures)

7399 (LBL-2978) ATOMIC ELECTRONS SHAKE-OFF ACCOMPANYING ALPHA DECAY. Rapaport, M. S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 64p. Dep. NTIS $6.25.

Thesis.

The α spectra associated with K-shell electron shake-off in ^{210}Po and ^{238}Pu decay were determined by K x-ray–α coincidence measurements. Although the shapes of the spectra generally agree with theoretical expectations, some discrepancies are observed. From similar measurements the α spectra associated with L- and M-shell electrons shake-off in ^{210}Po were determined. The abundances per α particle of the total K, L, and M electron shake-off effects were determined in these measurements and found to be $P_K = (1.65 \pm 0.16) \times 10^{-6}$, $P_L = (7.23 \pm 0.65) \times 10^{-4}$, and $P_M = (1.84 \pm 0.37) \times 10^{-2}$ for ^{210}Po and $P_K = (0.75 \pm 0.09) \times 10^{-6}$ for ^{238}Pu. Also, the abundances per α particle of the L subshell electron shake-off effect were found to be $P_{L_1} = (5.11 \pm 0.40) \times 10^{-4}$, $P_{L_2} = (0.62 \pm 0.06) \times 10^{-4}$, and $P_{L_3} = (1.50 \pm 0.19) \times 10^{-4}$. Only limits on the ionizations probabilities of M subshells could be determined. These limits were $P_{M_1} = 7$ to 23%, $P_{M_2} < 24\%$, $P_{M_3} < 17\%$, and $P_{M_4} + P_{M_5} > 47\%$ of the total. These results are also compared with theoretical predictions. Further experimental and theoretical studies are suggested. (13 figures, 5 tables). (auth)

7400 (LBL-3411) STUDY OF PARTIAL WAVE BRANCHING IN THE ALPHA DECAY OF ^{241}Am, ^{253}Es, AND ^{255}Fm. Soinski, A. J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 163p. Dep. NTIS $11.25.

Thesis.

Nuclei of ^{241}Am, ^{253}Es, and ^{255}Fm were oriented in single crystals of neodymium ethylsulfate at temperatures down to 11 mK. Orientation was detected by alpha particle angular distributions. The temperature dependences of these distributions are consistent with the lowest electronic states of these three actinide ions in the ethylsulfate lattice being similar to those of the corresponding lanthanide ions. Thus, magnetic and axial orientation was observed in $Es^{3+}(5f^{10})$, as in $Ho^{3+}(4f^{10})$. Quadrupole orientation was observed in $Am^{3+}(5f^6)$, as in $Eu^{3+}(4f^6)$. In $Fm^{3+}(5f^{11})$ the orientation was magnetic and equatorial, as would be expected from the hyperfine interaction in $Er^{3+}(4f^{11})$. The hyperfine interaction constants were determined. For ^{253}Es, $|A| = 0.26(3)$ cm^{-1} was measured; for ^{241}Am, $P = -0.0033(6)$ cm^{-1}; and for ^{255}Fm, $|B| = 0.035(7)$ cm^{-1}. The ^{253}Es nuclear magnetic dipole moment was determined to be $|\mu| = 2.7(13)\ \mu_N$. The Am^{3+} data are consistent with an antishielding constant of $\gamma_\infty \approx -10^3$, in good agreement with theory, and a shielding factor $\sigma_2 = 0.7$, similar to the value for Eu^{3+}. The nuclear results show that the s and d waves are in phase for the favored α-decay branch in all three cases. The relative phase of the g wave was found to be negative for the ^{253}Es decay. Numerical integration of the coupled second-order differential equations describing the favored α decays of ^{253}Es and ^{255}Fm yielded partial wave amplitudes and phases. The results are compared with both intensity and angular distribution data. The measurements of the angular distribution of spontaneous fission fragments from aligned nuclei of ^{253}Es, ^{254}Es and ^{257}Fm are described in a separate appendix. The ^{257}Fm results are consistent with a K quantum number at the outer turning point of either 9/2 or 7/2. (17 figures, 10 tables, 148 references) (auth)

7401 MULTIPLE-FOIL ACTIVATION MEASUREMENT OF THE ^{252}Cf FISSION-NEUTRON SPECTRUM. Etzion, M.; Spangler, R. G.; Draper, E. L. Jr. (Univ. of Texas, Austin). Trans. Amer. Nucl. Soc.; 19: 395-396(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7402 EQUILIBRIUM SPECTRUM OF DELAYED NEUTRONS FROM FAST FISSION OF ^{235}U. Evans, A. E.; East, L. V. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 396-397(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7403 RELATIVE THERMAL AND 450-keV FISSION PRODUCT YIELDS IN ^{239}Pu. Jensen, C. M. (Univ. of California, Livermore); Rogers, V. C.; Jensen, G. L. Trans. Amer. Nucl. Soc.; 19: 397-398(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7404 NUCLEAR AND PHYSICAL CONSTANTS FOR TRANSPLUTONIUM ELEMENTS. 1. Kon'shin, V. A. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 4, 26-34(1972). (In Russian).

A compilation and evaluation were made of all available experimental data on the fission cross section and capture cross section in the thermal neutron range, resonance fission integrals, and resonance capture integrals for ^{247}Cm, ^{249}Cf, and ^{251}Cf. In the event of the absence of reliable experimental data, as in the case of ^{249}Cf and ^{251}Cf, the evaluation of the capture cross section resonance capture integral was made from the systematics of the nucleus. Tables of the basic constants for the transplutonium elements were given. (tr-auth)

Nuclear Theory

Refer also to abstract 7329.

7405 (ORO-4317-43) COORDINATE-SPACE STUDY OF KOWALSKI'S THREE-TERM SEPARABLE APPROXIMATION FOR THE FULL OFF-SHELL TWO-NUCLEON T MATRIX. Technical Report No. 75-029. Picker, H. S.; Stephenson, G. J. Jr. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). Oct 1974. 35p. Dep. NTIS $4.75.

By using elementary coordinate-space methods, it is shown that a three-term separable approximate fully off-shell T matrix proposed by Kowalski can be reduced to a simpler expression. This T matrix incorporates off-shell unitarity exactly, is exact half off the energy shell, and is free from the spurious poles that arise in the Noyes approximation. However, numerical tests employing the wave-function model of Picker, Redish, and Stephenson show that, for realistic $^1S_0$ interactions, the Noyes approximation is more accurate than Kowalski's approximation except near the spurious pole at 250 MeV. A plausible explanation of this result is given. (10 figures, 2 tables). (auth)

7406 APPLICATION OF THE OPTICAL MODEL TO THE CALCULATION OF CROSS SECTIONS. Guasp, J. Energ. Nucl. (Madrid); 19: No. 88, 81-88(1974). (In Spanish).

A brief description is given of the application of the Optical Model to the prediction of fast neutron cross sections of nuclides with intermediate and high atomic number. The computer program HADES developed for the application of this model is cited in particular. A brief historical introduction is given first. The theory of the model is justified by the reduction of the many-body problem to the one-body problem with elimination of all inelastic channels. The phenomenological potentials commonly used in the model are described. The principal characteristics of the HADES program are given. (tr-auth)

7407 ZEEMAN NUCLEAR QUADRUPOLE RESONANCE LINE SHAPES IN POWDERS ($I = \frac{3}{2}$). Brooker, H. R. (Univ. of South Florida, Tampa); Creel, R. B. J. Chem. Phys.; 61: No. 9, 3658-3664(1 Nov 1974).

Theoretical absorption line shapes are presented for Zeeman perturbed nuclear quadrupole resonance transitions ($I = \frac{3}{2}$) in polycrystalline materials for the case in which the rf field is parallel to the Zeeman field. For a nuclear spin of $\frac{3}{2}$, the pure quadrupole transition frequency $\nu_Q(1 + \eta^2/3)^{\frac{1}{2}}$ is insufficient to independently determine either ν_Q, the strength of the quadrupole interaction, or η, the asymmetry in the electric field gradient tensor. Application of a magnetic field removes the degeneracy of the energy levels producing, in general, four orientation dependent transition frequencies from which the quadrupole parameters can be determined. Computer simulated powder lineshapes are presented which are exact in η and are to first order in applied magnetic field strength. Frequencies of the features of the line shape are plotted as a function of η. The features of the line shape are due to crystallites aligned such that the applied field is parallel to one of the principal axes of the electric field gradient tensor. The combined nuclear electric quadrupole and nuclear Zeeman Hamiltonian was solved exactly for these special orientations. Exact frequency expressions are calculated for these orientations of field with respect to the sample. These correspond to the frequencies of the features of the line shape. (auth)

7408 INVESTIGATION OF MECHANISM OF BACKWARD α-PARTICLE SCATTERING ON LIGHT NUCLEI. Kuznetsov, B. I.; Chernov, I. P. (Tomsk Polytechnical Inst., USSR). Yadern. Fiz.; 20: No. 4, 632-638(Oct 1974). (In Russian).

The mechanism of backward α-particle scattering is discussed. Based on qualitative and theoretical analysis of the experimental results a conclusion is drawn that the abnormal enhancement of the backward scattering cross section is due mainly to the contribution from the resonance scattering. In favor of this the following facts provide evidence: the excitation functions for the large angle scattering have a manifest resonance structure; the shape of angu-

lar distribution for large angle scattering is reasonably described by the Legendre polynomial with $l \sim kR$ squared; a satisfactory fit of data in framework of the resonance model–Regge-pole model. (auth)

7409 METHOD OF PARTIAL SELF-CONSISTENCY IN NUCLEAR SHELL MODEL. Birbrair, B. L.; Sadovnikova, V. A. (Leningrad Inst. of Nuclear Physics). Yadern. Fiz.; 20: No. 4, 645-657(Oct 1974). (In Russian).

A consequence from the gauge, rotational, and translational invariances of the theory is that the isovector and deformational terms in the average nuclear potential are to be related with the corresponding components of the residual interactions by the Hartree self-consistency conditions. A constructive method to parametrize the nuclear shell model potential is presented taking these conditions into account. The role of the self-consistency conditions in the problem of nuclear collective states is elucidated with the isobar-analog states as an example. (auth)

7410 MANY-BODY SCHROEDINGER EQUATION IN THE COLLECTIVE VARIABLES. Petrauskas, A. K.; Sabalyauskas, L. Yu. (Inst. of Physics and Mathematics, Vilnyus, USSR). Yadern. Fiz.; 20: No. 4, 658-665(Oct 1974). (In Russian).

Averaging the Hamiltonian over the external and internal Euler angles a set of differential equations for the determination of the nuclear wave functions is obtained. The calculation of the matrix elements in the internal basis is considered, and some general features of the solution of the obtained equations are discussed. (auth)

7411 RELATION BETWEEN THE RAYNAL–REVAI FOUR-PARTICLE COEFFICIENTS AND THE TALMI–MOSHINSKY THREE- AND TWO-PARTICLE COEFFICIENTS. Dzhibuti, R. I.; Shubitidze, N. I. (Inst. of Physics, Tbilisi, USSR). Yadern. Fiz.; 20: No. 4, 666-670(Oct 1974). (In Russian).

The transformation coefficients of hyperspherical functions for four bodies with unequal masses, constructed in various sets of the Jacobi coordinates, are related to the Talmi–Moshinsky three- and two-particle coefficients. Formulas are obtained resulting in a simplification of the calculation technique for the K-harmonics method applied to the four-body problem. (auth)

7412 FLUCTUATIONAL EMISSION OF γ QUANTA FROM ROTATING NUCLEUS. Pik-Pichak, G. A. (Inst. of Atomic Energy, Moscow). Yadern. Fiz.; 20: No. 4, 671-676(Oct 1974). (In Russian).

Spectral distribution of probability of the fluctuational emission of a γ quantum from a rotating nucleus per unit time is obtained in the classical approximation. At large viscosity related to the nuclear shape deformation, violating the axial symmetry, the emission has a collective nature. (auth)

7413 INCOHERENT SCATTERING OF HIGH ENERGY PHOTONS ON NUCLEI. Gevorkyan, S. R.; Zhamkochyan, V. M.; Koval, L. N.; Matinyan, S. G. (Erevan Physical Inst.). Yadern. Fiz.; 20: No. 4, 731-733(Oct 1974). (In Russian).

Incoherent Compton effect on nuclei is considered. The investigation of this process at high energies enables one to get useful information on mechanism of interaction of particles with nuclei. (auth)

7414 ANTISYMMETRIZATION IN RELATIVE COORDINATES. III. Total Fractional-Parentage Coefficients. Miglietta, F. (Univ., Paris). Nuovo Cim., 24A: No. 3, 353-358(1 Dec 1974).

A method is given to calculate directly the $\langle N|N-1\rangle$ total f.p.c. in relative coordinates. No relevant group-theoretical consideration is involved. The $\langle N|N-1\rangle$ f.p.c. are given as eigenvectors of a matrix whose elements are expressed in terms of the $\langle N-1|N-2\rangle$ f.p.c. (auth)

7415 ANTISYMMETRIZATION IN RELATIVE COORDINATES. IV. Nuclear-Structure Theory. Miglietta, F. (Univ., Paris). Nuovo Cim., 24A: No. 3, 359-367(1 Dec 1974).

A formulation of nuclear-structure theory in relative coordinates is given. Matrix elements of a two-body force Hamiltonian, and of one-body operators, for the N-particle problem, are expressed in terms of quantities, which refer to the (N–1)-particle problem, by means of the $\langle N|N-1\rangle$ fractional-parentage coefficients. (auth)

7416 INTERACTION OF A HYPERON WITH NUCLEAR MATTER AND ONE-BOSON EXCHANGE. Filimonov, V. A. (Tomsk Polytechnical Inst., USSR). Yadern. Fiz.; 20: No. 4, 746-755(Oct 1974). (In Russian).

The OBE model is applied to calculate the depth of the potential well for Λ in nuclear matter and the ratio R of the fictitious kinetic energy to the real one. R shows the dependence of D_Λ upon the Λ momentum. The exchange by octets of pseudoscalar, scalar, vector and pseudovector mesons is taken into account. The attraction between Λ and nuclear matter arises due to the exchange by a K^* meson and by a scalar iso-singlet σ meson. In the Hartree–Fock approximation, the momentum dependence of the well depth is a consequence of the nonlocality of ΛN interaction. The main contribution to R is from K^* exchange between Λ and N. (auth)

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 6089–6093, 6256, 6258, 6259, 6276, 6290, 6291, 6293, 6308, 6345, 6348, 6898, 7135, 7342, 7344, and 7453.

7417 (AD-777745) RIP, A ONE-DIMENSIONAL MATERIAL RESPONSE CODE. Volume II. Code Reference Manual. Final Report. Fisher, R. H.; Lane, G. A.; Cecil, R. A. (Systems, Science and Software, La Jolla, Calif. (USA)). Sep 1972. Contract DASA01-70-C-0055. 603p. (DNA-2993S-2). NTIS $11.00.

The radiation interaction program (RIP) was developed and documented as part of the DNA-sponsored predix programs. RIP is a one-dimensional, slab geometry, material response code. This code is used to calculate the response of homogeneous materials exposed to x-ray radiation, electron beams, plate impact, or an arbitrary time-dependent pressure boundary condition. The report describes the organization and storage requirements of the RIP code. In addition the definition and use of all blank and name common variables, a detailed description of each subroutine, each subroutine's relation to other parts of the code, and flow charts are included. (GRA)

7418 (COM-74-10750) MEASUREMENT OF DEPTH–DOSE DISTRIBUTIONS IN CARBON, ALUMINUM, POLYETHYLENE, AND POLYSTYRENE FOR 10-MeV INCIDENT ELECTRONS. Humphreys, J. C.; Chappell, S. E.; McLaughlin, W. L.; Jarrett, R. D. (National Bureau of Standards, Washington, D. C. (USA)). Nov 1973. 55p. NTIS $5.75.

Depth-dose distributions of 10-MeV electrons incident on homogeneous media of carbon, aluminum, polyethylene, and polystyrene have been measured using thin radiochromic dye-film dosimeters. Two types of dye-film dosimeters were employed as 'cavities' within the media in two different geometrical configurations. One configuration was a stack with the dosimeters interleaved between disks of the medium and placed perpendicular to the incident electron beam direction. The other configuration was a wedge assembly with a single piece of dye film placed between pieces of the medium at a small angle to the beam direction. The results show no significant difference between dosimeter type or experimental arrangement. In addition, good agreement is shown in comparisons of experimental and Monte Carlo calculated depth-dose distributions characterized by such parameters as extrapolated range, depth of peak dose, and ratio of peak to entrance dose. (auth)

7419 (COO-3243-3, pp 88–115) DOSIMETRY AND MICRODOSIMETRY OF 5.7-GeV NEON IONS. Gross, W.; Dicello, J.; Colvett, R. D. 1 Jul 1974.

In annual report on research project.

A limited quantity of central axis depth-dose information and microdosimetric measurement results obtained at a series of depths in a phantom with particular emphasis on positions just upstream from the Bragg peak are presented. These data are presented along with calculations of the biological effectiveness and oxygen enhancement ratio. (MHR)

7420 (COO-3243-3, pp 138–140) EXPERIMENTAL DETERMINATION OF ZETA. Kellerer, A. M.; Rossi, H. H. 1 Jul 1974.

In annual report on research project.

The need for the determination of the quantity ζ in regions of the dimension of nanometers was established. It is questioned whether registration of ions in the gas phase can yield the quantity ζ which based on energy deposition rather than the number of ions produced. It is pointed out that this can in principle be corrected. It is asked whether the efficiency of the detector is critical in the experiments. It is concluded that high efficiency of the detector is desirable. However, a value of the efficiency very close to 1 is not essential for the determination of ζ. (MHR)

7421 (COO-3243-3, pp 156–166) DOSE DEPENDENCE OF EFFECTS RESULTING FROM SHORT-RANGE INTERACTIONS. Kellerer, A. M.; Rossi, H. H. 1 Jul 1974.

In annual report on research project.

Radiation-induced sublesions in various higher organisms interact over distances of the order of one to several micrometers; this lead to a quadratic dependence of the cellular damage on specific energy in the nucleus or in certain sensitive regions of the nucleus. The question is asked whether similar considerations apply on a much smaller scale of the order of nanometers. The problem is analyzed. (MHR)

7422 (GSF-BT-171) ENERGY ABSORPTION IN SPHERICALLY SHAPED MICRO(CELL) REGIONS. Handl, J. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Hannover (F. R. Germany). Inst. fuer Strahlenbotanik; Technische Univ. Hannover (F. R. Germany). Fakultaet fuer Mathematik und Naturwissenschaften). Apr 1974. 66p. (In German). INIS.

27 figs.; 7 tabs.; 34 refs.

This work discusses and describes the investigation of the effect of ^3H for different distributions within or outside the cell membrane by means of a cell-model-like proportional counter. The data obtained are a reliable microdosimetric basis for determining the radiation effect to be expected as a result of investigations or biological conditions of the type described. (GE)

7423 (ORNL-4979, pp 73–76) MODIFICATIONS TO THE MR. ADAM PHANTOM. Stansbury, P. S.; Poston, J. W. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The modifications of MR. ADAM (Mockup of a Representative Analytical Description of an Adult Male) phantom to improve its resemblance to the newer mathematical model are described. As well as shape changes, some changes in materials are described. (MHR)

7424 (ORNL-4979, pp 77–78) COMPARISON OF THE GTC CROSS SECTIONS WITH ENDF/B III. Shonka, J. J.; Jones, T. D. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Several conclusions drawn from the comparison are listed. A detailed comparison was impossible because GTC had pseudo-reactions. This analysis can be summarized in two statements. First, the GTC library is still adequate for its purposes. Second, ENDF should be the library of choice for elements in the MIRD phantom. (MHR)

7425 (ORNL-4979, pp 125–139) INTERACTION OF RADIATION WITH LIQUIDS AND SOLIDS. Arakawa, E. T.; Birkhoff, R. D.; Braundmeier, A. J. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Brief discussion is given to the topics: ultraviolet optical properties of lithium, electron attenuation lengths in carbon films, plasmon resonance photoemission from aluminum, electron scattering lengths in aluminum determination from photoemission escape depths, radiation-induced changes in soft x-ray emission from LiF and NaCl, electrical conductivity and optical properties of (TTF) (TCNQ), effect of damming on surface-plasmon dispersion, a concentric angle doubler for vacuum ultraviolet studies, and photon scattering from cylinders. (CES)

7426 (ORNL-4979, pp 140–152) PHYSICS OF TISSUE DAMAGE. Arakawa, E. T.; Birkhoff, R. D.; Baird, J. K. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The following projects are described: collective electron effects in molecular liquids, collective oscillation in liquid water, optical properties of organic liquids, the index of refraction of aqueous solutions of alkali halides in the ultraviolet, electron slowing-down studies, radiation interactions with nucleic acid bases, optical and dielectric properties of DNA in the extreme ultraviolet, and optical properties of chloroplasts and red blood cells in the vacuum ultraviolet. (MHR)

7427 (ORNL-4979, pp 168–173) THEORETICAL RADIATION PHYSICS: PION BEAM DOSIMETRY. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The computer code PION-1, which was discussed in the previous annual report, has been further improved and used for several calculations related to the use of pions for cancer radiotherapy and also for calculations related to radiation protection. (MHR)

7428 (ORNL-4979, pp 173) THEORETICAL RADIATION PHYSICS: CONVERSION FACTORS FOR ESTIMATING DOSE AND DOSE EQUIVALENT FROM ^{11}C ACTIVATION. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Some preliminary calculations have been made of the ^{11}C activity in plastic scintillator disks placed at various depths in a water

phantom irradiation by a beam of neutron having an energy spectrum (maximum energy 400 MeV) similar to that used in an experiment at CERN. The calculated (absolute) and experimentally measured (relative) ^{11}C activity is shown as a function of depth. For a plastic cylinder of mass 1250 g irradiated by neutrons of energies 100, 250, and 400 MeV, the conversion factors in rems per ^{11}C activation per gram were found to be 5.2×10^{-5}, 5.5×10^{-5}, and 5.8×10^{-5} respectively. (MHR)

7429 (ORNL-4979, pp 178-180) THEORETICAL RADIATION PHYSICS: DISPERSION RELATIONS OF COLLECTIVE STATES WHEN DAMPING IS PRESENT. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Experimental work that demonstrates that the dispersion relation of the surface plasmon, when inferred from certain optical measurements, may be radically different from that deduced from electron energy loss determinations, is briefly discussed. (CES)

7430 (ORNL-4979, pp 180-181) THEORETICAL RADIATION PHYSICS: ENERGY GAIN FROM SURFACE PLASMONS IN ELECTRON ENERGY LOSS EXPERIMENTS. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The probability of electron energy gain was estimated in a grazing-incidence configuration corresponding to the experiments of Schilling and Raether, [J. Phys. C. 6, L 358, (1973)] assuming that fast electrons may be represented adequately in terms of plane-wave eigenfunctions. These electrons are assumed to interact pairwise through the surface-plasmon field. (MHR)

7431 (ORNL-4979, pp 181-183) THEORETICAL RADIATION PHYSICS: THE IMPACT PARAMETER REPRESENTATION OF CHARGED-PARTICLE ENERGY LOSSES IN CONDENSED MEDIA. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The impact parameter representation of energy loss was studied in terms of the general dielectric response function of a medium. For simplicity, the case is considered in which the dielectric function of the medium depends only on energy transfer and on the magnitude of the momentum transfer. (MHR)

7432 (ORNL-4979, pp 183-186) THEORETICAL RADIATION PHYSICS: RADIATIVE CAPTURE OF ELECTRONS BY SWIFT IONS IN SOLIDS. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Recent experiments have established the surprising fact that photons resulting from the capture of electrons by swift ions traversing solids can now be measured. The experiments are sufficiently precise that both the cross sections for the radiative transitions and the distribution of the resulting photons in energy may be determined. Here standard radiation theory was used together with a statistical model of electron states in a single crystal lattice of atoms in order to analyze the results of these experiments. (MHR)

7433 (ORNL-4979, pp 186-188) THEORETICAL RADIATION PHYSICS: SURF-RIDING ELECTRON STATES TRAILING SWIFT IONS IN CONDENSED MATTER. Ritchie, R. H.; Anderson, V. E.; Ashley, J. C. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The shape of the potential in the wake of a swift charged particle is approximated to obtain a simple result. The oscillatory portion of the potential energy function of an electron moving with the ion is shown in a schematic representation. Variational estimates were made of the binding energy of electrons in surf-riding states. The variation of the ground-state binding energy is displayed for an electron surf-riding in the first potential through ($m = 0$) behind hydrogen, oxygen, and sulfur ions as a function of their kinetic energy. Possible consequences of surf-riding states in solids are discussed briefly. (MHR)

7434 (ORNL-TM-3048) PRINT-SIG, AN OGRE ROUTINE TO PRINT GAMMA-RAY TOTAL CROSS SECTIONS AND ENERGY DEPOSITION COEFFICIENTS. Trubey, D. K. (Oak Ridge National Lab., Tenn. (USA)). 11 Oct 1968. 10p. Dep. NTIS $4.00.

An auxiliary routine was written to print gamma-ray total cross sections and energy absorption coefficients. The OGRE cross section system is utilized to generate the basic data. (auth)

7435 (UCID-15971) ELASTIC NUCLEAR SCATTERING OF DEUTERONS AND ALPHAS IN DEUTERIUM. Corman, E. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 10 Dec 1971. Contract W-7405-eng-48. 12p. Dep. NTIS $4.00.

It has been found that the nuclear force field makes an appreciable contribution to the elastic scattering of light, low-Z ions, along with the Coulomb force field, which dominates at very small angles. Most of the existing Monte Carlo codes use standard expressions for the rate of energy loss of an ion. To calculate the effect of the nuclear contribution to the elastic scattering in a Monte Carlo code, it appears reasonable to sample scattering angles from the difference differential cross section, that is, the measured (presumably total) minus the calculated Coulomb, which yields the nuclear (plus the nuclear-Coulomb interference). This appears to be a good supplement to the Coulomb, already accounted for in the usual dE/dx expressions that yield the continuous loss of energy over the ion path. Therefore, tables of $z = \cos\theta$ were calculated for convenience in sampling polar scattering angles as a function of the energies E_d and E_α. (2 tables) (RWR)

7436 DEPTH DOSE DISTRIBUTIONS IN WEDGE FIELDS OF ^{60}Co BEAMS. Patomaeki, L. K.; Kiuru, A. (Kuopio Univ. (Finland). Dept. of Physics). Strahlentherapie; 147: No. 6, 611-618 (Jun 1974).

5 figs.; 2 tabs.; 12 refs.

The depth dose distribution in a wedge field of ^{60}Co external beams was studied on the basis of both theoretical calculations and experimental measurements. A difference of a few percentages was found by theoretical calculations in the relative depth dose distributions of the wedge field and the respective non-wedge field particularly in the largest fields. Depending on the distance of the wedge filter from the skin, the gamma radiation scattered from the filter may at least partly compensate the theoretical difference. The dependence of the dose distribution on the filter to skin distance as well as the dependence of the transmission factor on the method of locating the filters are pointed out. (auth)

7437 SINGLE-TO-TOTAL ALBEDO RATIO FOR 660-keV PHOTONS. Elias, E.; Notea, A.; Segal, Y. (Technion-Israel Inst. of Tech., Haifa). Trans. Amer. Nucl. Soc.; 19: 81-82(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7438 GAMMA-INDUCED IONIZATION RATE PULSE BROADENING IN THE UPPER ATMOSPHERE. Roberts, J. P.; Wicklund, J. S. (Harry Diamond Labs., Washington, DC). Trans. Amer. Nucl. Soc.; 19: 441-442(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7439 IMPLEMENTATION OF IMPROVED BOUNDED ESTIMATION OF FLUX-AT-A-POINT FOR SEVERAL DETECTORS. Steinberg, H. (Mathematical Applications Group, Inc., Elmsford, NY). Trans. Amer. Nucl. Soc.; 19: 442(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7440 PERTURBATION APPROXIMATION TO CHARGED-PARTICLE TRANSPORT. Wilson, J. W. (National Aeronautics and Space Administration, Hampton, VA); Lamkin, S. L. Trans. Amer. Nucl. Soc.; 19: 443(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7441 DOSE RATE KERNEL FOR AIR-SCATTERED ^{16}N DECAY GAMMA RAYS. Ward, J. T. Jr. (Westinghouse Electric Corp., Richland, WA); Pigford, T. H. Trans. Amer. Nucl. Soc.; 19: 446-447(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7442 NEUTRON DOSE CALCULATIONS FOR ARRAYS OF FISSILE MATERIAL. Hunt, D. C.; Dickinson, D. (Dow Chemical Co., Golden, CO). Trans. Amer. Nucl. Soc.; 19: 450-451(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7443 ENHANCED FROM LOW-ENERGY BREMSTRAHLUNG FOLLOWING HIGH-/LOW-Z INTERFACES. Langworthy, J. B. (Naval Research Lab., Washington, DC); Rosen, M.; Attix, F. H.; Gorbics, S. G.; Seltzer, S. M. Trans. Amer. Nucl. Soc.; 19: 453-454(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7444 SENSITIVITY OF DOSE IN A BUILDING TO INITIAL RADIATION SOURCE ELEVATION ANGLES. Beer, M.; Cohen, M. O. (Mathematical Applications Group, Inc., Elmsford, NY). Trans. Amer. Nucl. Soc.; 19: 454-455(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7445 NEW SCATTERING CROSS SECTIONS FOR ELECTRON TRANSPORT. Haggmark, L. G. (Sandia Labs., Livermore, CA); MacCallum, C. J.; Riley, M. E. Trans. Amer. Nucl. Soc.; 19: 471(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7446 LOSS OF POLARIZATION BY A DEUTERON BEAM IN HYDROGEN. Ad'yasevich, B. P.; Antonenko, V. G. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 66: No. 6, 1911-1915(Jun 1974). (In Russian).

Tensor polarization losses by a 60 to 370 keV deuteron beam traversing hydrogen at a pressure of 20 mm Hg are measured. The polarization is measured in a pressure range from 1 to 20 mm Hg for an energy of 229 keV on entrance into the gas. Computer Monte Carlo calculations lead to overestimates of polarization losses and hence at low energies the polarization of a beam passing through a gas can be determined only by experimental means. (auth)

7447 SPATIAL DISTRIBUTION OF RADIATION INTENSITIES AND ABSORBED DOSES UNDER CONDITION OF NON-EQUILIBRIUM OF SECONDARY RADIATION. Dubinin, I.; Pohlova, L. (Universita J. E. Purkyne, Brno (Czechoslovakia). Lekarska Fakulta). Cesk. Radiol.; 27: No. 6, 415-419(Nov 1973). (In Czech).

A general analytical expression was derived for the spatial distribution of intensity and of absorbed doses of radiation that comprises both the primary and the secondary radiation. Point sources located inside and outside the absorbing medium were considered in calculations. (INIS)

7448 EXPERIMENTAL AND CALCULATED 2, 6, 8, 19, AND 25 MeV BREMSSTRAHLUNG SPECTRA FROM MEDICAL ELECTRON ACCELERATORS. Levy, L. B. San Antonio, TX; Univ. of Texas (1974). 142p. University Microfilms Order No. 74-25,482.

Thesis (Ph. D.).

The bremsstrahlung spectra from the following medical electron accelerators have been measured: 2 MVp resonant transformer, 2 MeV Van de Graaff generator, 6 and 8 MeV linear accelerator, 19 MeV betatron, and a 25 MeV linear accelerator. A spectrometer system incorporating a 12.7 cm × 12.7 cm NaI (Tl) crystal, a pulse pile-up rejector/restorer, and a multichannel analyzer was used for the measurements. Also, depth dose and narrow beam attentuation data were measured under identical conditions for the electron accelerators. The effective energies derived from the narrow beam attenuation data were 0.81, 0.83, 1.61, 1.9, 7.8, and 8.1 MeV for the Van de Graaff generator, resonant transformer, 6 MeV linac, 8 MeV linac, 19 MeV betatron, and the 25 MeV linac, respectively. The depth dose consistently increased with an increase in quality of the beam except for the 19 MeV and 25 MeV machines, where the depth dose was approximately the same from the build-up point (3.75 cm) to a depth of 14 cm in water. The depth dose beyond 14 cm favored the slight difference in beam qualities and was consistently greater for the 25 MeV unit. (Diss. Abstr. Int., B)

Radiation Protection Standards

7449 (BNL-19213, pp 39-42) UNCHANGING ASPECTS OF RADIATION EXPOSURE LIMITS. Meinhold, C. B. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1-December 31, 1973.

Radiation exposure limits have changed very little since the mid 20's and those changes which have come about have only rarely been a direct result of the introduction of new radiobiological data. Mutscheller's work in Germany in the 1920's led directly to the first internationally recognized standard of 0.2 R/day. To be sure, his measurements were hardly quantitative, but his methodology of considering that exposure limitations be based on a criteria of general well-being for workers exposed below such a limit was excellent. He further determined that they could continue their work under such a guideline. This combination forms a proper foundation for standards setting philosophy. The development of radiation dose limits for the general population and personnel in the USA through 1972 is reviewed. The role of the Federal Radiation Council, the National Council on Radiation Protection and Measurements (NCRP), and the National Academy of Science (NAS) in establishing these dose limits is discussed. (CH)

Radiation Source Calibration and Standardization

7450 CALIFORNIUM-252 FAST-NEUTRON REFERENCE SPECTRA. Meyer, W. (Univ. of Missouri, Columbia); Mutone, G. A.; Leighty, J. W. Trans. Amer. Nucl. Soc.; 19: 480-481(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Shielding Calculations and Experiments

Refer also to abstracts 7327, 7328, 7330, 7661, and 7875.

7451 (ORNL-4979, pp 207-208) SHIELDING MATERIALS FOR HIGH-YIELD NEUTRON SOURCE CARRIERS. Kerr, G. D.; Abdullah, S. A.; Auxier, J. A.; Cheka, J. S.; Dickson, H. W.; Fox, W. F.; Jones, T. D.; Lupica, S. B.; Shonka, J. J.; Wilhoit, D. G. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Several materials were investigated as suitable replacements for paraffin and fiberboard in source carriers for sealed isotopic neutron sources. A search for a conventional formable material failed to produce any of sufficiently low density that were both fire and impact resistant. One has, however, been developed that appears to be promising as a replacement for paraffin. This material uses polyethylene and boric acid as the primary shielding material with a fire-resistant mineral binder containing fibrous strengthening agents. (MHR)

7452 MUTUAL SHIELDING OF INITIAL RADIATION IN BUILDING STRUCTURES. Beer, M.; Cohen, M. O. (Mathematical Applications Group, Inc., Elmsford, NY). Trans. Amer. Nucl. Soc.; 19: 443-444(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7453 ANDOF: A CODE FOR CALCULATING ANGULAR FLUXES FROM SURFACES WITH ARBITRARY SOURCE DISTRIBUTIONS. Almenas, K.; DeGangi, N. (Univ. of Maryland, College Park). Trans. Amer. Nucl. Soc.; 19: 455-456(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7454 ALBEDO DATA BASE SUITABLE FOR MONTE CARLO CALCULATIONS: NEUTRON, GAMMA-RAY, AND SECONDARY GAMMA-RAY DATA. Simmons, G. L.; Albert, T. E.; Gritzner, M. L. (Science Applications, Inc., Huntsville, AL). Trans. Amer. Nucl. Soc.; 19: 473-474(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

PHYSICS (THEORETICAL)

General

Refer also to abstract 7223.

7455 WAVE MECHANICS AND ITS APPLICATIONS. Gombas, P.; Kisdi, D. International Series of Monographs in Natural Philosophy, Volume 58. Elmsford, NY; Pergamon Press, Inc. (1973). 247p. $10.50.

The discussion of wave mechanics and its applications covers the experimental basis, the Bohr atom model, the elements of wave mechanics, simple examples of solutions of the Schroedinger equation, scattering problems, and the simplest approximate methods and their applications. (JFP)

7456 MEASUREMENT AND IRREVERSIBILITY IN INFINITE SYSTEMS. Bona, P. (Komenskeho Univerzita, Bratislava (Czechoslovakia). Prirodovedecka Fakulta). Acta Phys. Slovaca; 23: No. 3, 149-157(1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (16 Oct 1972).

The problem of measurement in quantum theory is schematically formulated and new possibilities are shown of solving the problem of measurement through the introduction of systems with infinitely many degrees of freedom. (auth)

7457 REALIZATIONS OF THE POINCARE GROUP ON HOMOGENEOUS SPACES. Lassner, W. (Sektion Physik, Karl-Marx-Universitaet, Leipzig (German Democratic Republic)). Acta Phys. Slovaca; 23: No. 4, 193-202(1973).

From elementary particle physics seminar; Pezinska Baba, Czechoslovakia (22 Sep 1971).

A classification of realizations of the Poincaré group in homogeneous spaces is given. (auth)

Quantum Field Theories

Refer also to abstracts 7229 and 7283.

7458 (JINR-E2-8023) GROUP-STRUCTURE OF THEORIES IN THE INFINITE MOMENTUM FRAME. Toth, K. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 32p. Dep. NTIS (US Sales Only) $4.75.

It is widely believed, that there is a correspondence between infinite momentum frame physics and two-dimensional Galilean physics. This is usually demonstrated by arguing, that Weinberg's rule for old-fashioned perturbation series in the infinite momentum limit can be interpreted as a perturbation series in a two-dimensional Galilean theory. In order to find for this more solid basis, than the usual heuristic arguments, a systematic investigation of the group structure of interacting scalar field theory is performed. It turns out, that the above mentioned correspondence is not necessary. There is a one-parameter freedom in determining the group structure of the infinite momentum frame theory. This parameter has similar meaning to light velocity: when it is finite, one has a relativistic theory, when it is infinite, one has a Galilean theory. It is shown, that Weinberg's above rule may equally well be interpreted as a "noncovariant perturbation series" in a two-dimensional relativistic theory. Possibilities of making use of the two-dimensional relativistic scheme are also discussed. (auth)

7459 (JINR-E2-8277) ACTION PRINCIPLE IN SUPER-SPACE. Mezincescu, L.; Ogievetsky, V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1974. 12p. Dep. NTIS (US Sales Only) $4.00.

The action for superfields is represented as an integral over both usual and spinor coordinates. An analog of δ-function is defined for anticommuting variables. In this approach all the calculations are manifestly invariant at each stage with respect to Fermi–Bose symmetry transformations. (auth)

7460 (JINR-P2-8052) REGGEON RESCATTERING IN ϕ^4 THEORY. Gershkevich, M. V.; Efremov, A. V. (Joint Inst. for Nuclear Research,Dubna (USSR). Lab. of Theoretical Physics). 1974. 20p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

In the α-representation all logarithms of the Mandelstam diagram in the ϕ^4-theory are summed up. It is showed that despite the absence of the rapid decrease of the off-shell scattering amplitude the rescatterings of the Regge poles as well as the fixed square-root branch points, appearing in the ϕ^4-theory together with the Regge poles, are described by the usual formula. (auth)

7461 SUPER-QUANTIZATION, 2. General Functional Integration Formula. Okubo, Susumu (Rochester Univ., N. Y. (USA). Dept. of Physics and Astronomy). Progr. Theor. Phys. (Kyoto); 51: No. 3, 920-944(Mar 1974).

It was shown that with a general definition of time-ordered products, a unitary S-matrix for fields with multi-dimensional coordinates can be expressed in a form of Feynman's functional (or path) integral. Though one need not assume the existence of the equation of motion for a free field, the result is found to be the equivalent to a formal introduction of generally nonlocal and possibly hermitian free action. A direct proof of the unitarity of the S-matrix as well as Bogoliubov causality condition is presented on the basis of the path-integral formula. A possible unitarization of nonlocal interaction theories is suggested by means of the same method. Finally, as an application, a quantum statistical partition function for a boson field is given in the path-integral form. (auth)

7462 EXTENSION OF THE RENORMALIZABLE THEORIES. d'Auria, A. C. (Istituto di Matematica della Facolta di Ingegneria, Naples); Esposito, U. Nuovo Cim., 24A: No. 3, 285-293(1 Dec 1974).

A contribution is given in extending the class of renormalizable theories by using the equations for the Green's function. Three models are studied, two of which are renormalizable if the coupling constant can be interpreted as a differential operator. (auth)

Gravitation and General Relativity

Refer also to abstracts 7053 and 7211.

7463 PROBLEM OF THE DETERMINATION OF GENERAL RELATIVISTIC SPACES BY THEIR SCALAR DIFFERENTIAL INVARIANTS. Stunz, H. C. Washington, DC; George Washington Univ. (1974). 70p. University Microfilms Order No. 74-22,265.

Thesis (Ph. D.).

The problem of the determination of Riemann spaces, in particular general relativistic spaces, is considered by the use of their intrinsic scalar differential invariants, and a solution to this problem for a restricted class of metrics which serve to generate approximating spaces for a given Riemann space is described. The algebraic (point-wise) equivalence of tensor fields is examined in this connection for both the Maxwell and conformal (Weyl) tensors. For the problem, it is clear that the determination of a Riemann space through a set of scalar differential invariants requires an investigation of the classification of this type of scalar fields and of their consistency with a given Riemann manifold, i.e., whether the given fields are derivable from a Riemann space as scalar differential invariants. A review of some classical results on these questions is given, together with their application to this work. As an attack on the general problem, a procedure is described for the construction of a class of pseudo-Riemann spaces of Lorentzian signature which are completely determined by a finite set of scalar invariants. The spaces of this class are conformally flat and admit no nondiscrete isometry groups. The procedure may be generalized to arbitrary dimension and signature. It is then shown, that starting with the spaces of this class one can construct metrics which are also completely determined by a finite set of invariants, and which serve to approximate any sufficiently differentiable space of Lorentzian signature to arbitrary degree, on a region which is independent of the degree of approximation. (Diss. Abstr. Int., B)

7464 SOLUTIONS OF SOME SELECTED PROBLEMS IN GENERAL RELATIVITY. Wang, M. Y. Notre Dame, IN; Univ. of Notre Dame (1974). 76p. University Microfilms Order No. 74-25,938.

Thesis (Ph. D.).

Solutions to three problems in general relativity are presented. These are a class of new solutions of static axially symmetric Einstein-Maxwell equations, elastic scattering of test particles from a source whose exterior geometry is described by the Kerr metric and the problem of extending Carter's theorem to black holes carrying charge. (Diss. Abstr. Int., B)

7465 INTRODUCTION TO GENERAL RELATIVITY. Atwater, H. A. International Series of Monographs in Natural Philosophy, Volume 63. Elmsford, NY; Pergamon Press, Inc. (1974). 231p. $11.00.

The topics cover tensor analysis, equations of motion of free particles, solutions of the field equations, electromagnetism in general relativity, gravitational fields and waves, relativity in cosmology, unified theories and quantized theories of general relativity, and Minkowski coordinates and orthogonal transformations. (JFP)

7466 HIGHER ORDER GRAVITATIONAL POTENTIAL FOR MANY-BODY SYSTEM. Ohta, Tadayuki (Seikei Univ. (Japan). Dept. of Mathematical Physics); Okamura, Hiroshi; Kimura, Toshiei; Hiida, Kichiro. Progr. Theor. Phys. (Kyoto); 51: No. 4, 1220-1238(Apr 1974).

Gravitational potential for many-body system is obtained up to post-post-Newtonian order of approximation from the metric tensor derived previously, which is Minkowskian at spatial infinity. The calculation is based on the Lagrangian or Fokker type. The transverse-traceless part of the metric tensor contributes to the potential of post-post-Newtonian order, even to the G^3-static part. The fact that the G^3-static potential includes the contribution from the transverse-traceless part is the manifestation of non-linear nature of the theory of gravity. The gravitational potential obtained here coincides with that calculated in the canonical formalism, but does not coincide with that obtained in the conventional formalism of quantized theory. (auth)

REACTOR TECHNOLOGY AND REGULATION

7467 (EPRI-NP-1) NUCLEAR POWER DIVISION TECHNICAL PROGRESS REPORT. Levenson, M. (Electric Power Research Inst., Palo Alto, Calif. (USA)). Sep 1974. 24p. NTIS $4.00.

The division objectives and goals are discussed and the research programs are summarized. Program areas included pressure boundary, plutonium recycle, realiability and diagnostics, earthquake and tornado effects, operating benchmarks, water reactor safety, corrosion and chemistry, and in-service inspection. (JWR)

7468 (JPRS-63420) TRANSLATIONS ON EASTERN EUROPE. Scientific Affairs, No. 437. 12 Nov 1974. Translation of Articles on Eastern Europe. 71p. NTIS.

Abstracts were prepared for 2 of the articles included. The remaining articles are outside the scope of NSA. (JWR)

For abstracts of individual papers see: 7506 and 7663.

7469 TRANSACTIONS OF THE AMERICAN NUCLEAR SOCIETY 1974 WINTER MEETING, WASHINGTON, DC, OCTOBER 27-31, 1974. Farmakes, R. (ed.). Trans. Amer. Nucl. Soc.; 19: 1-482(1974). (CONF-741017-).

Each of the 502 brief summaries included is listed by title in NSA. The summaries cover sessions on aerospace and hydrospace, controlled nuclear fusion, education, environmental sciences, isotopes and radiation, materials science and technology, mathematics and computation, nuclear criticality safety, nuclear fuel cycle, nuclear reactor safety, power, reactor operations, reactor physics, and shielding and dosimetry. (DCC)

For abstracts of individual papers see: 5550–5554, 5573, 5592, 5627, 5702, 5703, 5711, 5725, 5726, 5736, 5746, 5769, 5775, 5799–5831, 5853–5856, 5863, 5864, 5920–5923, 5957, 5958, 5960, 5973, 5979, 5980, 5986, 6005, 6026–6044, 6098–6104, 6147–6149, 6210, 6211, 6217–6223, 6227, 6233–6236, 6283, 6306–6308, 6351–6354, 6437–6440, 6470–6487, 6525–6527, 6543, 6578–6583, 6698–6700, 6730, 6731, 6757–6766, 6779–6785, 6788–6815, 6894, 6939–6941, 7333–7344, 7362, 7388, 7401–7403, 7437–7445, 7450, 7452–7454, 7470–7483, 7488–7501, 7507–7535, 7545–7548, 7552–7554, 7606–7649, 7679–7699, 7706, 7707, 7712, 7746–7804, 7831–7850, 7862–7876, 7880–7885, 7892–7900, 7904–7911, 7915–7919, 7931–7942, and 7983.

7470 FIVE YEARS EXPERIENCE WITH A NUCLEAR ENGINEERING TECHNOLOGY PROGRAM. Hornyik, K.; Wang, C. H. (Oregon State Univ., Corvallis). Trans. Amer. Nucl. Soc.; 19: 28-29(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7471 COMBINED GRADUATE CO-OP, AEC TRAINEESHIP PROGRAM. Meem, J. L. (Univ. of Virginia, Charlottesville). Trans. Amer. Nucl. Soc.; 19: 29-30(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7472 NUCLEAR ENGINEERING AT THE INSTITUTO DE ENERGIA ATOMICA. Franco, R. R.; Hukai, R. Y. (Istituto de Energia Atomica, Sao Paulo, Brazil). Trans. Amer. Nucl. Soc.; 19: 30(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7473 TECHNICAL TRAINING FOR UTILITY AND DESIGNER STAFF AT AN NSSS DESIGNER ORGANIZATION. Grady, J. D. (Westinghouse Electric Corp., Pittsburgh). Trans. Amer. Nucl. Soc.; 19: 299(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7474 CONSTRUCTION MANPOWER ASPECTS OF NUCLEAR POWER STATIONS. Nagle, E. C. (United Engineers and Constructors, Philadelphia). 19: 300-301(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7475 WHAT IS THE NUCLEAR INDUSTRY DOING. What Must it do. Deutsch, R. W. (General Physics Corp., Columbia, MD). Trans. Amer. Nucl. Soc.; 19: 301(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7476 WHAT CAN UNIVERSITIES DO. What are They Doing Now. Long, R. L. (Univ. of New Mexico, Albuquerque). Trans. Amer. Nucl. Soc.; 19: 301-302(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7477 TRAINING, TECHNICAL ASSISTANCE, AND QUALITY ASSURANCE PROGRAMS IN A DEVELOPING COUNTRY. Rosen, M. (International Atomic Energy Agency, Vienna). Trans. Amer. Nucl. Soc.; 19: 327(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7478 NUCLEAR POWER AND AEROSPACE PROJECTS: A COMPARISON OF ORGANIZATION AND MANAGEMENT METHODS. Fies, C. L. (Washington Public Power Supply System, Richland). Trans. Amer. Nucl. Soc.; 19: 329-330(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7479 UPGRADING PERSONNEL THROUGH ORGANIZATION DEVELOPMENT AT AN NSSS DESIGNER ORGANIZATION. Gibson, D. J.; Arnold, W. H. Jr. (Westinghouse Electric Corp., Pittsburgh). Trans. Amer. Nucl. Soc.; 19: 330-331(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7480 QUALITY ASSURANCE IN THE DESIGN OF NUCLEAR POWER PLANTS AS SEEN BY AN ARCHITECT-ENGINEER. Laughton, W. M. (Stone and Webster Engineering Corp., Boston). Trans. Amer. Nucl. Soc.; 19: 332(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7481 QUALITY PROGRAM FOR CONSTRUCTION OF NUCLEAR POWER PLANTS. Pfeiffer, J. L. (Bechtel Power Corp., San Francisco). Trans. Amer. Nucl. Soc.; 19: 332(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7482 NUCLEAR PLANT CONSTRUCTION IN JAPAN. Cartwright, P. (General Electric Co., San Jose, CA). Trans. Amer. Nucl. Soc.; 19: 342(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7483 QUALITY ASSURANCE IN OPERATIONS. Squires, R. J. (Commonwealth Edison Co., New York). Trans. Amer. Nucl. Soc.; 19: 357(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7484 NUCLEAR POWER PLANTS OF THE USA. Falaleev, P. P.; Voronin, L. M.; Ponomarev, Yu. V. Energ. Stroit. Rubezhom; No. 2, 3-10(1973). (In Russian).

In the USA, nuclear power plants have reached a significant place in the energy picture. In 1980 their total power should reach 150 million kW (22% of the all electric power), and in 1990, 500 million kW (40%). From 1971 to 1980 the main installations are expected to be light-water reactors with thermal neutrons. The unit power of such stations in the next 10 years will be 800–1200 MW. The chief suppliers of equipment for these plants are Westinghouse, Babcock-Wilcox, and Combustion Engineering. The characteristics of pressurized-water- and boiling-water-cooled reactors are given. Fast-neutron reactors are still experimental. The main proposed components of modern nuclear power stations are examined, the chief feature of which is location of the basic components of the reactor section in shielded shells, calculated for an internal pressure of 4.5 kgs/cm^2. For ensuring sealing, the inner surfaces of the shells are lined with 12-mm-thick sheet carbon steel. The characteristics of the Peach Bottom station, with a 45-MW(e) high-temperature gas reactor and two 1000-MW(e) boiling-water reactors are presented. Likewise given are data on the 60-MW(e) Enrico Fermi fast reactor and two boiling-water-cooled 1100-MW(e) reactors, on the Dresden with boiling-water-cooled reactors, one with 200 MW(e) power and two with 809 MW(e), and on the San Onofre with pressurized water reactors, one with 450 MW(e) and two with 1140 MW(e). (tr-auth)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 5698, 6806, 7716, 7721, 7725, 7726, 7734, 7739–7742, 7748, 7789–7791, 7798, 7806, 7809, 7849, 7898, 7918, and 7919.

7485 (EPRI-SR-2) ADVANCED RECYCLE METHODOLOGY PROGRAM: PRELIMINARY SPECIFICATIONS FOR A NEW NUCLEAR COMPUTATIONAL CAPABILITY. Zolotar, B. A.; Eich, W. J. (Nuclear Associates International Corp., Rockville, Md. (USA)). Jul 1974. 23p. NTIS

For Electric Power Research Inst., Palo Alto, CA.

The computer code package for the analysis of light water reactor core physics and thermal-in lattices designed for plutonium recycle hydraulic performance is described. (JWR)

7486 (RT/ING-(74)19) EXPERIMENTAL INVESTIGATION OF MASS VELOCITY DISTRIBUTION AND VELOCITY PROFILES IN AN LWR ROD BUNDLE. Marinelli, V.; Pastori, L.; Kjellen, B. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jul 1974. 37p. (CONF-720686-7). Dep. NTIS (US Sales Only) $5.00.

From European two-phase flow group meeting; Rome, Italy (6 Jun 1972).

Experimental data of mass velocity distribution among the subchannels of a square geometry 4×4 rod test section under single-phase flow conditions are presented. The data are compared with the calculation results obtained by means of the LEUCIPPO computer code and also by means of Ibragimov theory. (auth)

7487 NUCLEAR POWER PLANT ISAR. State Report at Half Construction Line. Rieser, R. (Kernkraftwerk Isar G.m.b.H., Muenchen (F. R. Germany)). Energie; 26: No. 6, 202-207(Jun 1974). (In German).

8 figs.; 3 refs.

The intended building time for the KKI is 60 months. A half-time balance and a description of the technical particularities of the plant are presented. In particular, the choice of site, the nuclear steam generator plant as well as the cooling water supply and the electrotechnical system are discussed. (GE)

7488 CORROSION-PRODUCT RADIOISOTOPE CONCENTRATIONS IN BOILING WATER REACTORS. Shaw, R. A.; Skarpelos, J. M. (General Electric Co., San Jose, CA). Trans. Amer. Nucl. Soc.; 19: 103(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7489 OPTIMAL PIN ENRICHMENT DISTRIBUTIONS BY GRADIENT SEARCH TECHNIQUES. Lim, E. Y. (Stanford Univ., CA); Leonard, A. Trans. Amer. Nucl. Soc.; 19: 172(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7490 NUCLEAR PRESSURE VESSEL DESIGN. Cooper, W. E. (Teledyne Materials Research, Waltham, MA). Trans. Amer. Nucl. Soc.; 19: 282(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7491 LIGHT-WATER-REACTOR PRESSURE VESSEL MATERIALS AND FABRICATION. Harris, R. L. (Tennessee Valley Authority, Knoxville). Trans. Amer. Nucl. Soc.; 19: 282-283 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7492 IT'S ONLY AS GOOD AS THE PEOPLE THEREIN. Duba, F. T. (Hartford Steam Boiler Inspection and Insurance Co., CT). Trans. Amer. Nucl. Soc.; 19: 283(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7493 ASSURING PRESSURE VESSEL RELIABILITY IN SPITE OF RADIATION EMBRITTLEMENT. Steele, L. E. (Naval Research Lab., Washington, DC). Trans. Amer. Nucl. Soc.; 19: 283-284(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7494 CONTAINMENT INERTING: AN END IN SIGHT. Bieniarz, P. P. (Energy Inc., Idaho Falls, ID). Trans. Amer. Nucl. Soc.; 19: 312-314(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7495 NUCLEAR-THERMAL-HYDRAULIC CHARACTERISTICS OF BWR FUEL BUNDLES. Doi, K.; Kiguchi, T.; Uchikawa, S.; Takeda, R. (Hitachi, Ltd., Japan). Trans. Amer. Nucl. Soc.; 19: 319-320(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7496 PLUTONIUM RECYCLE FUEL PERFORMANCE IN BWRs. Baily, W. E.; Bishop, D. M.; Ogawa, S. Y.; Proebstle, R. A. (General Electric Co., San Jose, CA). Trans. Amer. Nucl. Soc.; 19: 348(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7497 SAFEGUARDS FOR PU RECYCLE IN LWRs. Higinbotham, W. A.; Weinstock, E. V. (Brookhaven National Lab., Upton, NY). Trans. Amer. Nucl. Soc.; 19: 349-350(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7498 ON-LINE DIAGNOSIS OF OFF-NORMAL BEHAVIOR IN RECIRCULATION SYSTEMS. Angle, C. W. (Dairyland Power Corp., Genoa, WI); Thie, J. A. Trans. Amer. Nucl. Soc.; 19: 362 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7499 HVAC SYSTEM ACCEPTANCE TESTING EXPERIENCE AT A NUCLEAR POWER PLANT. Bundy, H. F. (Burns and Roe, Inc., Richland, WA); Vesy, C. J. Trans. Amer. Nucl. Soc.; 19: 368(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7500 PEACH BOTTOM UNIT NO. 2 OFF-GAS CATALYTIC RECOMBINER SYSTEM OPERATION. Doering, J.; Gaffin, N. H. (Philadelphia Electric Co.). Trans. Amer. Nucl. Soc.; 19: 372 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7501 PLANNING FOR THE OYSTER CREEK RADWASTE MODIFICATIONS. Montgomery, C. R. (GPU Service Corp., Parsippany, NJ); Rosen, S. S.; Hendricks, J. R. Trans. Amer. Nucl. Soc.; 19: 372-374(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7502 INSERVICE INSPECTION OF NO. 2 REACTOR IN FUKUSHIMA NUCLEAR POWER PLANT. Nakamura, Ryoichi (Tokyo Electric Power Co. Inc. (Japan)). Karyoku Genshiryoku Hatsuden; 25: No. 3, 219-234(Mar 1974). (In Japanese).

Preservice inspection was performed before the start of operation of the nuclear power plant, under the same conditions and with the same equipments as those in inservice inspection, in order to obtain basic data to compare with the test results of the inservice inspection. The preservice inspection was planned so as to employ a remotely controlled automatic ultrasonic flaw detection system in the region of high radiation level such as reactor core, and to employ a manual ultrasonic flaw detection system or other non-destructive inspection method in the other regions. The sorts of inspection employed for Fukushima No. 2 reactor were naked eye test, surface test, and volume test, which are prescribed in ASME CODE. The preservice inspection was satisfactorily performed. Some problems were pointed out. In the ultrasonic inspection of welded part, relatively high echo was generated from the back side, so that it was difficult to distinguish defect echo and back echo. Therefore, the back surface of welded part must be finished. (JA)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 7485, 7486, 7489–7494, 7497, 7713, 7716, 7718–7721, 7725, 7726, 7734, 7736–7740, 7748, 7789, 7790, 7795–7797, 7801, 7806, 7809, 7849, 7918, 7919, and 7921.

7503 (BAW-10100) REACTOR VESSEL MATERIAL SURVEILLANCE PROGRAM. Compliance with 10 CFR 50, Appendix H, for Oconee Class Reactors. Palme, H. S.; Carter, G. S.; Whitmarsh, C. L. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Oct 1974. 50p. Babcock and Wilcox, Lynchburg, VA.

The reactor vessel material surveillance program utilized on B&W 177 fuel assembly reactors (Oconee class) for which the surveillance specimens had not been prepared prior to issuance of Appendix H to 10 CFR 50 on July 17, 1973 is described. The purpose of the surveillance program is to monitor changes in fracture toughness properties of reactor vessel beltline region materials. Test data obtained from the surveillance program allows a determination of the margin of safety against fracture

and a determination of the conditions under which the reactor vessel may be operated. In this program Charpy V-notch, tension, and, in selected cases, half-inch compact tension test specimens are placed in six capsules which contain dosimeters and temperature monitors. Two of these capsules are placed in each of three holder tubes centered about the reactor core mid plane near the reactor vessel wall. The type and number of specimens, and the number of capsules are in accordance with the requirements of Appendix H to 10 CFR 50. The materials selected for surveillance monitoring are those identified as being the materials which will first control the operating limitations of the reactor vessel during its service life. The variables considered for the material selection are listed. (auth)

7504 (FRNC-CONF-102) LIGHT WATER REACTOR FAMILY: GENERAL DATA; UNITS NOW IN CONSTRUCTION IN FRANCE. Leny, J. C.; Saitcevsky, B. (Societe Franco-Americaine de Constructions Atomiques (FRAMATOME), 92 - Courbevoie (France); Electricite de France, 69 - Lyon. Region d'Equipement). 1973. 26p. (In French). (CONF-730983-21). Dep. NTIS (US Sales Only) $4.50.

From congress of the Society of Electrical, Electronic and Radio Engineers meeting; Vittel, France (11 Sep 1973).

Since 1969, the French program has shifted towards the light water enriched uranium type of reactor. Apart from the Franco-Belgian projects at Chooz and Tihange, E. D. F. has committed funds for four almost identical 900 MW WESTINGHOUSE PWR units at Fessenheim and Bugey. For successful implementation of an industrial nuclear power program greater than the conventional thermal one the options chosen have already been tried and proven elsewhere, and standardization is aimed at. The main factors borne in mind by the authority responsible for commissioning and then running a plant, and also those pertinent to the French constructor and supplier of the nuclear boiler are discussed. At present these are trends in safety criteria, behavior of fuel, and behavior of the steam generator tubework. (FR)

7505 (FRNC-CONF-116) ELECTRICAL PUMP UNITS FOR THE PRIMARY WATER CIRCUITS OF HIGH POWER PWR REACTORS. Bergougnan, P.; Ruyant, F. (Societe Jeumont-Schneider, 75 - Paris (France)). 1973. 19p. (In French). (CONF-730983-29). Dep. NTIS (US Sales Only) $4.00.

From congress of the Society of Electrical, Electronic and Radio Engineers meeting; Vittel, France (11 Sep 1973).

The purpose of the pumps for the primary water circuits of nuclear power plants and the first models built (namely, canned motor pumps, characterized by absolutely no leakage) are recalled. Throughflow rates have quadrupled in the last decade, and the electrical pumps must display a high degree of inertia. This together with the development of rotating seal technology for high pressure circuits has led to the design of this equipment of favor pumps with a controlled rate of leakage. The constitution and technology of the shaft-seal pumps now used in high power modern nuclear plants are described. The characteristics of the main components (the hydraulic elements, the seal features, the driving motor, the thrust bearing, and flywheel) are given. (FR)

7506 (JPRS-63420, pp 14-22) PROGRESS AND TASKS OF CONSTRUCTION OF THE PAKS NUCLEAR POWER PLANT. Nagy, Z. 12 Nov 1974. Translated from Energ. Atomtech.; No. 8, 347-353(1974).

The status of construction of the Paks Nuclear Power Plant are reviewed. The plans for additional facilities at the site are discussed. (JWR)

7507 SIMILARITY MODEL OF A PWR POWER PLANT. Cardon, J. J. (Brigham Young Univ., Provo, UT); Jensen, W. D.; Rogers, V. C.; Thurgood, M. J.; Sandquist, G. M. Trans. Amer. Nucl. Soc.; 19: 27-28(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7508 PROBABILISTIC ANALYSIS FOR STEADY-STATE FUEL-ROD TEMPERATURES. Chy, B. B.; Fernandez, R. T. (Electrical Power Research Inst., Palo Alto, CA). Trans. Amer. Nucl. Soc.; 19: 111-112(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7509 EVALUATING THE SOLUTIONS TO FUEL DENSIFICATION. Andrews, M. G.; Harkness, S. D.; Duncan, R. N.; Pati, S. R. (Combustion Engineering Inc., Windsor, CT). Trans. Amer. Nucl. Soc.; 19: 140-141(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7510 EFFECTS OF DESIGN PARAMETERS ON COLLAPSE TIME FOR FUEL RODS. Chesebrough, D. E.; Wilson, H. W. (Babcock and Wilcox Co., Alliance, OH). Trans. Amer. Nucl. Soc.; 19: 145-146(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7511 THERMAL SPECTRUM REACTORS: A SPENT-FUEL AFTERHEAT COMPARISON. Angelo, J. A. Jr.; Post, R. G. (Univ. of Arizona, Tucson). Trans. Amer. Nucl. Soc.; 19: 209 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7512 USE OF IN-CORE INSTRUMENTATION IN COMBUSTION ENGINEERING POWER REACTORS. Ober, T. G.; Gavin, P. H. (Combustion Engineering, Inc., Windsor, CT). Trans. Amer. Nucl. Soc.; 19: 218-219(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7513 BABCOCK AND WILCOX FUEL MANAGEMENT DATA PROCESSING SYSTEM. Robertson, J. D. (Babcock and Wilcox, Lynchburg, VA). Trans. Amer. Nucl. Soc.; 19: 219(1974).

From meeting of the American Nuclear Society, Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7514 WESTINGHOUSE AXIAL POWER DISTRIBUTION MONITORING SYSTEM. Easter, J. R. (Westinghouse Electric Corp., Pittsburgh). Trans. Amer. Nucl. Soc.; 19: 219-220(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7515 STUDY OF THORIUM UTILIZATION IN LSWs. Lin, C. L. C.; Zolotar, B. A. (Electrical Power Research Inst., Palo Alto, CA). Trans. Amer. Nucl. Soc.; 19: 222(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7516 CALCULATION OF PWR CORE BEHAVIOR USING THE LEAHS SYSTEM. Rothleder, B. M.; Eich, W. J.; Fisher, J. R.; Fuierer, A. A. (Nuclear Associates International Corp., Rockville, MD). Trans. Amer. Nucl. Soc.; 19: 226-227(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7517 OPTIMIZED PWR OFF-GAS SYSTEM. Stewart, J. E. (Cosmodyne, Torrance, CA); Khandhar, M. K.; Desai, A. M. Trans. Amer. Nucl. Soc.; 19: 311-312(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7518 NEW DIMENSION IN CRITICAL HEAT FLUX TESTING. Wilson, R. H. (Babcox and Wilcox Co., Lynchburg, VA); Fiveland, W. A. Trans. Amer. Nucl. Soc.; 19: 318(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7519 DYNAMIC SIMULATION OF THE OCONEE-TYPE ONCE-THROUGH STEAM GENERATOR. Chen, A. T.; Kerlin, T. W. (Univ. of Tennessee, Knoxville). Trans. Amer. Nucl. Soc.; 19: 338-339(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7520 MANUFACTURE OF NUCLEAR POWER PLANTS. Turner, J. E. (Offshore Power Systems, Jacksonville, FL). Trans. Amer. Nucl. Soc.; 19: 341(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7521 SMALL PWR FOR INDUSTRIAL ENERGY. Klepper, O. H. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 354-355(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7522 STAFFING, TRAINING, AND UTILIZATION OF A NUCLEAR PLANT'S TECHNICAL PERSONNEL. Plunkett, T. F. (Indiana and Michigan Power Co., Bridgman, MI). Trans. Amer. Nucl. Soc.; 19: 358-359(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7523 PWR POWER DISTRIBUTION RESULTS FROM MANY CYCLES OF OPERATION. Harris, R. T. (Northeast Utilities

Service Co., Hartford, CT); Traggio, R. P.; Kirschner, B. W. Trans. Amer. Nucl. Soc.; 19: 360(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7524 USE OF THE AXIAL POWER DISTRIBUTION MONITORING SYSTEM IN H. B. ROBINSON. Crawford, C. W. (Carolina Power and Light Co., Hartsville, SC); Chambers, R. H.; Waters, D. B. Trans. Amer. Nucl. Soc.; 19: 360-361(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7525 MONITORING OCONEE I INTERNALS WITH NEUTRON NOISE ANALYSIS. Pettus, W. G.; Currie, R. L. (Babcock and Wilcox Co., Lynchburg, VA). Trans. Amer. Nucl. Soc.; 19: 361-362(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7526 ZERO (LOW)-POWER PHYSICS TESTING FOR B AND W NUCLEAR STEAM SUPPLY SYSTEMS. Coppola, E. J. (Babcock and Wilcox Co., Lynchburg, VA); Scott, T. F.; Worsham, H. J. Jr.; Kane, E. R.; Gmach, J. A. Trans. Amer. Nucl. Soc.; 19: 364-365(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7527 DOPPLER CORRECTION IN DIFFERENTIAL ROD-WORTH MEASUREMENTS AT POWER. Snidow, N. L. (Babcock and Wilcox Co., Lynchburg, VA); Matheson, R. C.; Kelly, W. M. Trans. Amer. Nucl. Soc.; 19: 365-366(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7528 MEASURED CORE STABILITY TO AN INDUCED DIAGONAL XENON OSCILLATION. Tulodieski, D. B. (Babcock and Wilcox Co., Lynchburg, VA); Robertson, J. R.; Putnam, J. M. Trans. Amer. Nucl. Soc.; 19: 366-367(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7529 KEWAUNEE NUCLEAR POWER PLANT STARTUP FEEDWATER PUMP PROBLEM. Giesler, C. W. (Wisconsin Public Service Corp., Green Bay). Trans. Amer. Nucl. Soc.; 19: 370(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7530 PILGRIM NUCLEAR POWER STATION FIRST REFUELING OUTAGE PLANNING AND PERFORMANCE. Martin, S. (Boston Edison Co., Plymouth, MA). Trans. Amer. Nucl. Soc.; 19: 370-371(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7531 ARKANSAS NUCLEAR ONE INDUSTRIAL SECURITY SYSTEM. Cavanaugh, W. III; Ewing, E. C. III. (Arkansas Power and Light Co., Little Rock). Trans. Amer. Nucl. Soc.; 19: 371 (1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7532 FORT CALHOUN STARTUP AND ITS IMPORTANCE RELATIVE TO FIRST YEAR UNIT AVAILABILITY. Wicina, R. C. (Omaha Public Power District, NE). Trans. Amer. Nucl. Soc.; 19: 372(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7533 NOISE ANALYSIS INVESTIGATION AT THE OCONEE NUCLEAR POWER PLANT. Robinson, J. C. (Univ. of Tennessee, Knoxville); Mott, J. E.; Currie, R. L.; Penland, J. R. Trans. Amer. Nucl. Soc.; 19: 383(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7534 ANALYSIS OF NEUTRON-DENSITY OSCILLATIONS RESULTING FROM CORE-BARREL MOTION IN A PWR NUCLEAR POWER PLANT. Fry, D. N. (Oak Ridge National Lab., TN); Kryter, R. C.; Robinson, J. C. Trans. Amer. Nucl. Soc.; 19: 383-384(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7535 THEORETICAL CONSIDERATIONS IN DETERMINING REACTOR INTERNALS MOTION FROM STOCHASTIC SIGNALS. Thie, J. A. Trans. Amer. Nucl. Soc.; 19: 384-385(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7536 COMPARISON OF CONVENTIONAL AND BINARY HEAT CYCLE FOR PRESSURIZED WATER REACTOR NUCLEAR POWER PLANTS. Ambroz, J. (Ceske Vysoke Uceni Technicke, Prague (Czechoslovakia)). Strojirenstvi; 23: No. 11, 666-671 (Nov 1973). (In Czech.).
For a 1000 MW(e) pressurized water reactor nuclear power plant, a comparison is presented of steam circulation and binary circulation, in which in the last part of the expansion steam is substituted with ammonia. Specific heat consumption and construction possibilities of all main parts of the equipment are compared for the two cases. It is shown that in the proposed configuration both cycles have almost identical heat consumption and the attained simplified design of the turbines cannot offset the large and costly heat exchangers of the binary circulation. (auth)

7537 CONSTRUCTION OF CONTAINMENT SUPERSTRUCTURES OF NUCLEAR POWER PLANTS WITH PWR REACTORS. Antipin, A. I. Energ. Stroit. Rubezhom; No. 1, 3-8 (1973). (In Russian).
Nuclear power stations having pressurized water reactors shielded with iron-concrete shells have an inner shell of sheet steel. The construction and technological order of stressed reinforced shells were examined. According to one method, bundles of vertical wall fittings are attached to the upper edges of the walls and are tightened in the semi-based gallery. In a second method, the fittings are attached to the base of the shell and tightened from above. A scheme for mechanization and the engineering of the building of the "Trojan" and "Robinson" (USA) nuclear power station shells is presented. In the Trojan station, in the shell, along with the usual fittings, high-strength fittings are used in semi-rigid bands. The rules for tightening high-strength fittings are given. The method of reinforcing vertical high-strength fittings with tightening increases the volume and the laboriousness of the work and complicates their technology and their reciprocal attachment. To take care of these problems, in the Robinson station a new method of compressing the shell was used—compression of only the vertical high-strength fittings of individual rods placed in steel tubes with anticorrosion covering. (tr-auth)

7538 FUEL ROD FAILURE OF MIHAMA NO. 2 NUCLEAR POWER PLANT. Kume, Sanshiro (Osaka Univ., Toyonaka (Japan). Faculty of Science). Kagaku (Tokyo); 44: No. 3, 173-179(Mar 1974). (In Japanese).
The reasons of fuel rod failure at Mihama No. 2 plant are conjectured, based on the interim report on the accident. As the introduction, the outline of the interim report is given. Next, the author emphasizes the significance of fuel rod failure in LWR plants. The technical aspects in the design and performance of fuel clads of PWR are discussed with the concluding remark that the fuel pins are the key point of the safety and economy of nuclear power plants. Three reasons of fuel rod failure, namely collapse, swelling and bowing, are considered. Of which, the bowing is discussed in detail because it is the most probable cause. (JA)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 7511, 7724, 7728–7730, and 7922.

7539 (AECL-4916) CANDU: ECONOMIC ALTERNATIVE TO THE FAST BREEDERS. Mooradian, A. J.; Runnalls, O. J. C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Sep 1974. 22p. (CONF-740910-3). Dep. NTIS (US Sales Only) $4.25.
From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974).
The inventory of uranium and thorium within 1.6 km (1 mile) of the earth's land mass is sufficient to meet all world energy demands for 10^8 years, even if world requirements rose from 0.2 Q/yr to 10 Q/yr (1 Q = 10^{18} Btu = 2.9×10^{14} kWht). The crustal abundance of uranium is 3 g/Mg (3 ppm) and that of thorium is 10 g/Mg (10 ppM). Any material which contains uranium and/or thorium at a concentration 0.3 g/Mg (0.3 ppM) is energy ore as rich as good coal. It is unlikely that fission reactors will be short of fuel recoverable at acceptable costs into the very long term future. The fast breeder reactor concept is important because it promises to reduce the sensitivity of fuel cycle costs to increases in uranium resource recovery costs. The CANDU reactor option is important because it is already insensitive to uranium re-

source recovery costs and can be made even less sensitive by plutonium recycle and the introduction of the thorium cycle into a system which is operating today at a commercial level of confidence. The purpose of this paper is to examine the characteristics of the CANDU reactor system and present its flexibility of response to the uncertainties which are likely to characterize resource recovery costs in the near term. The fuel resource question is viewed from the perspective of Canadian experience. The basis for optimism is developed for the long term supply of uranium and thorium at costs which are acceptable to the CANDU system. It will be shown that the concept is not only complementary to the fast reactor but is also a viable economic alternative. (auth)

7540 (GA-A-13079) FORT ST. VRAIN STARTUP TEST A-3: PULSED-NEUTRON EXPERIMENTS. Pfeiffer, W.; Brown, J. R.; Marshall, A. C. (General Atomic Co., San Diego, Calif. (USA)). Jul 1974. Contract AT(04-3)-633. 168p. Dep. NTIS $7.60.

Pulsed-neutron experiments were performed on the Fort St. Vrain high-temperature gas-cooled reactor to determine the reactivity of the core for various control rod configurations while the reactor was still subcritical. For the configurations near critical, the neutron generation time was also determined. The configurations pulsed were primarily those which will be encountered during normal operation or those which have safety implications. Thus these experiments provided a valuable check of the nuclear design. Two methods were used to interpret most of the results. For all configurations the reactivity (or equivalently the multiplication constant, k_{eff}) was inferred from the inhour equation using the measured decay constant, α, of the fundamental mode and a calculated generation time, Λ. For configurations near critical, both k_{eff} and Λ were determined using the extrapolated area-ratio method. For a pair of configurations very near critical, k_{eff} and Λ were also measured using another, unnamed method. The originally calculated (i.e., predicted) values for α, k_{eff}, and Λ agree poorly with those determined experimentally. The discrepancies observed are evidently due to a deficiency in the treatment of the reflector in the original calculational model. By adding 5 ppm of natural boron in the reflector model, the calculated values for α, k_{eff}, and Λ are brought into very good agreement with the measured and inferred values for all control rod configurations. An investigation revealed that the impurity level of the reflector was in fact measured to be higher than assumed in the original calculations and may well be consistent with the proposed adjustment in the calculational model. It is significant that the adjustment improves the agreement between the calculated and inferred k_{eff} values primarily by changing the inferred values, not the calculated values. Consequently, the originally calculated (predicted) values for control rod worths, shutdown margin, etc. are only slightly conservative and require no major revisions. (auth)

7541 (GA-A-13175) INVESTIGATION INTO THE CAUSE AND CONSEQUENCE OF THE FORT ST. VRAIN PELTON WHEEL INCIPIENT FRACTURES. (General Atomic Co., San Diego, Calif. (USA)). 16 Oct 1974. Contract AT(04-3)-633. 100p. Dep. NTIS $5.45.

During a fluorescent penetrant (Zyglo ZL-22) inspection of a cast Inconel 718 Pelton wheel removed from service at Fort St. Vrain (FSV), cracks were discovered at the roots of the Curvic coupling teeth and at the bottom end of the Pelton bucket splitter. Six consecutive buckets out of twenty were found to have similar incipient cracks in the same location. None of these cracks were visible to the naked eye. This casting was serial number (S/N) 4. A Pelton casting (S/N 3) from the same heat, which was used at the Valmont test facility but not at FSV, was inspected by the same technique. Similar cracks were found in the roots of the Curvic coupling teeth, but none were found in the buckets. The mating Curvic coupling of S/N 4 on the steam turbine disc (wrought 422 stainless) was checked in a similar manner and found to be without flaws. There are two other Curvic couplings in the machine which are also wrought 422 stainless. These were also checked and found to be without flaws. In addition, ten prenuclear Pelton wheels used at FSV, two of which were also cast 718, were checked and found to be without flaws. Castings S/N 3 and 4 were subjected to extensive metallurgical and engineering examination and testing, and the following conclusions were reached: (1) All cracking is attributed to high-cycle fatigue. (2) The evidence strongly suggests that the cracks in the Curvic coupling were formed at Valmont and caused by the abnormal steam conditions used at that facility. (3) The cracks in the Pelton wheel buckets (S/N 4) were formed at FSV and were caused by high-speed water operation. (4) Fracture mechanics analytical methods supported by experimental testing show these cracks to be self-arresting at all the required operating conditions, and they will therefore not impair the function or safety of the circulators. (auth)

7542 (GAMD-7904) FISSION PRODUCT CONTROL AND FUEL ELEMENT RELEASE AT THE PEACH BOTTOM HTGR NUCLEAR POWER STATION. Results of Postconstruction Research and Development Procedures DM-1, GM-1, GM-2, JM-1, and JM-8. Lofing, D. R.; Anderson, E. E.; Bell, W. E. (Gulf General Atomic Co., San Diego, Calif. (USA)). 30 Jul 1972. Contract AT(04-3)-314. 59p. Dep. NTIS $6.00.

During startup and operation of Core 1 in the Peach Bottom HTGR Nuclear Power Station, various tests were performed to study the release of noble gas and iodine fission products into the helium coolant system, and the performance of the coolant gas purification system. The results of these tests are presented. (12 references) (auth)

7543 (NP-20231) HEAT TRANSFER IN THE COAL GASIFICATION WITH NUCLEAR REACTOR HEAT. Anton, P. (Technische Hochschule Aachen (F. R. Germany). Mathematisch-Naturwissenschaftliche Fakultaet). 6 Jul 1973. 133p. (In German). INIS.

Thesis. 20 figs.; 25 tabs.; 67 refs. With abstract. Available from the library of the Technische Hochschule Aachen.

Heat transfer for the gasification of coal with steam on a large technical scale is examined. The whole plant thus consists of a gas-cooled high temperature nuclear reactor and the actual gasifier. An attempt is made to calculate from the data of the nuclear reactor and gasifier as well as the heat transfer characteristics fundamental data such as coal conversion, heat exchange surface, size and shape of the pressure vessel, mass and energy flow and specific gasification capacity and thus to obtain a proposal for a technically realizable concept. A helium cooled pebble bed reactor is used as a basis for the whole plant which has a thermal capacity of 3,000 MW. (GE)

7544 THE GAS TURBINE AND ITS APPLICATIONS. Sueddtsch. Ztg., Beil. Mensch Tech.; 16: No. 230, 1-8(Aug 1974). (In German).

With figs. and tabs.

Conventional applications of gas turbines are reported in several articles. The nuclear aspect is considered in an article: the helium turbine in the circuit of a high-temperature reactor. (GE)

7545 ADVANCES IN HIGH-TEMPERATURE GAS-COOLED REACTOR CONTAINMENT VENTILATION SYSTEMS. Krane, P. M. (General Atomic Inc., San Diego, CA). Trans. Amer. Nucl. Soc.; 19: 314-315(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7546 OPERATING EXPERIENCE WITH STEAM GENERATORS IN GAS-COOLED REACTORS. Bomelburg, H. J.; Schuetzenduebel, W. G. (General Atomic Inc., San Diego, CA). Trans. Amer. Nucl. Soc.; 19: 362-363(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7547 NUMERICAL EVALUATION AND GRAPHIC DISPLAY OF XENON OSCILLATIONS IN HIGH-TEMPERATURE REACTORS. Lauer, A.; Schwiegk, H. J.; Wolf, L. (Kernforschungsanlage, Juelich, Ger.). Trans. Amer. Nucl. Soc.; 19: 376-377(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7548 SHIELDING ASPECTS OF HTGR REFUELING. Su, S. D. (General Atomic Inc., San Diego, CA). Trans. Amer. Nucl. Soc.; 19: 474-475(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7549 PROBLEMS ON NUCLEAR REACTOR STRUCTURE AT ELEVATED TEMPERATURE. Hasegawa, Masayoshi (Waseda Univ., Tokyo (Japan)); Suzuki, Hiroshige; Fujimura, Tadato; Uga, Takeo; Miyazono, Shohachiro. Nippon Genshiryoku Gakkaishi; 14: No. 11, 619-639(Nov 1972). (In Japanese).

In fast breeder reactors, high temperature gas-cooled reactors, and nuclear fusion reactors, technical methods and standards employed for light water reactors must be reconsidered in view of reactor design and safety, because operational temperatures are higher in the new type reactors. Problems on the materials and design of fuel, reactor core, reactor pressure vessels, and piping in the primary system are introduced and examined. As to the reactor core and the core materials, present status and problems on fuel temperature, coated fuel particles, carbon material for fuel assembly, graphite moderator, and heat-insulating material are introduced. As for the structural materials used at high temperature, stability of the materials against the irradiation of neutrons, strength and ductility, corrosion resistance to coolant, and workability including welda-

bility are necessary. From the standpoint of structure design, emphasis must be laid on the design of high temperature parts rather than pressure boundaries. Examination in detail is under way on the extension of conventional structure design methods to high temperature, material strength at high temperatures, application of creep strength to design, mutual relation of high temperature fatigue failure and creep failure, acceleration of deformation by thermal ratchet and thermal load, and creep buckling. (JA)

Power Reactors, Non-Breeding, Otherwise Moderated

Refer also to abstracts 7792–7794.

7550 (EUR-5183e) REACTIVITY EFFECTS OF BURNT FUEL ROD CLUSTERS IN D_2O MODERATED REACTORS. Hage, W.; Hettinger, H.; Hohmann, H.; Kumpf, S.; Schneider, J.; Tinagli, F.; Toselli, F. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). Sep 1974. 30p. Dep. NTIS (US Sales Only) $4.50. EUR B. FR.50.-.

Reactivity effects of burnt fuel clusters were measured in the D_2O moderated critical facility ECO using the pile oscillation technique. Results are given for three UO_2 cluster types and in three burnup steps from 0 to 9500 MWd/t, at three lattice pitches for air, D_2O and H_2O coolants. The reactivity effects were measured with an inverse neutron kinetics technique, which took into account the decay of the delayed neutron precursors in the fuel element part which was temporarily outside the reactor. 8 references. (auth)

7551 SOME WELDING REQUIREMENTS OF THE CANDU NUCLEAR STEAM SUPPLY SYSTEM. Sedmihradsky, P. Can. Welder Fabr.; 65: No. 8, 16-22(Aug 1974).

Stringent design and inspection specifications for the tube-to-tubesheet welds in the steam generators of CANDU system reactors are necessary to prevent any leakage of heavy water. AECL design requirements include ultrasonic inspection, liquid penetrant inspection, and helium bubble testing of all welded joints. In addition, a hydrostatic test of the completed steam generator at 1½ times design pressures is called for. Welds are finally re-examined for defects by magnetic particle techniques, and again, ultrasonically. (CA)

7552 COMPARATIVE EXAMINATION OF CRUD FROM TWO HEAVY-WATER REACTORS. Andrews, D. G.; de Ruyter, M.; Switzer, T. (Univ. of Toronto). Trans. Amer. Nucl. Soc.; 19: 103-105(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7553 PERFORMANCE, STRENGTH, AND CORROSION RESISTANCE OF BRAZED JOINTS ON CANDU FUEL BUNDLES. Hardy, D. G. (Atomic Energy of Canada Ltd., Chalk River, Ont.); Graham, N. A. Trans. Amer. Nucl. Soc.; 19: 122-123(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7554 PULSED-GASEOUS-CORE REACTOR POWER PLANTS. Dugan, E. T.; Diaz, N. J. (Univ. of Florida, Gainesville). Trans. Amer. Nucl. Soc.; 19: 355-356(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Power Reactors, Breeding

Refer also to abstracts 7549, 7687, 7692, 7714, 7715, 7722, 7727, 7744, 7745, 7749, 7754, 7755, 7757–7764, 7766, 7767, 7769, 7770, 7772–7788, 7821, 7887–7891, 7895–7897, 7899, and 7900.

7555 (COO-2245-11TR) VELOCITY MEASUREMENTS IN EDGE SUBCHANNELS OF WIRE WRAPPED LMFBR FUEL ASSEMBLIES. Chen, Y. B.; Ip, K.; Todreas, N. E. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Nuclear Engineering). Sep 1974. Contract AT(11-1)-2245. 245p. Dep. NTIS $15.25.

Velocity profile in the edge subchannel of a 61 wire wrapped pin bundle with a 12-inch axial wire pitch was measured. The experiments were performed in water at both laminar and turbulent regimes. In both cases the axial velocity seems to have developed fully within the 2nd axial pitch while the transverse velocity still appears to be developing in the 2nd pitch. The axially averaged transverse gap velocity was found to be about 13% and 10% of the bundle average velocity for the turbulent and laminar flow cases respectively. The average edge subchannel axial velocity was found to be about 1.04 and 1.19 times the bundle average velocity for the turbulent and laminar case respectively. The experiments were repeated with a 6-inch axial wire pitch. The axially averaged transverse gap velocity is 21% and 17% of the bundle average velocity for the turbulent and laminar flow cases respectively. The average edge subchannel axial velocity remains about the same as for the 12'' pitch case with 1.02 and 1.24 for turbulent and laminar respectively. (auth)

7556 (EPRI-SR-3) BREEDER BENEFITS AND URANIUM ORE AVAILABILITY. Manne, A. S.; Yu, O. S. (Electric Power Research Inst., Palo Alto, Calif. (USA)). 1 Oct 1974. 37p. NTIS.

An analytical model which projects the interaction of alternative future electricity generating systems, with their corresponding fuel needs and constraints, under specified assumptions of demand growth is described. The model has been constructed around the future role of the Fast Breeder Reactor in a mix of nuclear, coal, and possible advanced concept power systems. Although this model is in an early stage of development, it does illustrate some general trends which may be basically valid. First, under conditions of increasing uranium ore costs with increasing cumulative demand, there appears to be a strong economic justification for an FBR program—even with wide variations of the assumed parameters. Second, that the anticipated R&D costs of many billions of dollars for the FBR fall well within the range which would justify the program. Third, even under the extreme assumption of constant uranium ore cost, the FBR may have a small net economic value—especially if other advanced concepts are not successful. Fourth, in the absence of a successful FBR or advanced concept, the future demand for coal would be enormous. (TSS)

7557 (GEAP-13997) WIRE-WRAP FUEL ASSEMBLY TECHNOLOGY REQUIREMENTS. Punches, J. R. (comp.). (General Electric Co., Sunnyvale, Calif. (USA). Advanced Technology Dept.). Nov 1973. Contract AT(04-3)-893. 81p. Dep. NTIS $5.45.

The requirements for technical attention to wire-wrapped fuel assemblies in order to meet the present schedule for the first LMFBR Demonstration Plant have been studied. The extensive effort which will be required involves both the development of new and better analytical tools, particularly computer codes, and the performance of many tests to establish the characteristics of the materials involved and the design configuration chosen. The technical results of this study are summarized, including priority efforts required. (auth)

7558 (HEDL-TME-74-44) EBR-II SPECTRAL PARAMETERS (REACTOR RUN 50H). Simons, R. L.; Ulseth, J. A.; Graves, N. J. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Jul 1974. Contract AT(45-1)-2170. 13p. AT.

Flux-spectrum maps were prepared from EBR-II (run 50H) reaction rate data to provide values for total flux, fraction of the flux with E > 0.1 MeV, mean neutron energy, and atom displacement rates for 18/10 stainless steel, as well as values for the spectral averaged damage function for 1% swelling in solution-treated Type 304 stainless steel. The maps encompass the core, upper and lower reflector regions from −68 to +76cm from midplane, and the row 7 and 8 radial blanket. In the absence of detailed reaction rate data specific for particular experiments, the first four irradiation parameters are recommended as the minimum to be reported in evaluations and correlations of structural and cladding experiments conducted in EBR-II prior to the incorporation of the radial stainless steel reflector (run 56). (auth)

7559 (KFK-1273/2) FAST BREEDER PROJECT. Progress Report for the Second Quarter, 1973. Hueper, R. (comp.). (Kernforschungszentrum Karlsruhe (F. R. Germany)). Sep 1973. 302p. (In German). (EUR-4970d). Dep. NTIS (US Sales Only) $18.25.

Progress is reported in the following study areas: fuel pin development, materials, fuel cycle, reactor kinetics, reactor safety, sodium compatibility, heat transfer, and fluid flow. (DG)

7560 (WARD-RB-3045-6) RADIAL BLANKET DESIGN AND DEVELOPMENT. Quarterly Progress Report for the Period Ending May 31, 1974. Bishop, E. C. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Oct 1974. Contract AT(11-1)-3045. 44p. AT.

Progress in the design and development of LMFBR radial blankets during the quarter is reported. The research included heat transfer testing, irradiation testing in EBR-2, and a flow orificing test. (JWR)

7561 (WARD-XS-3045-7) PHYSICS EVALUATIONS AND APPLICATIONS. Quarterly Progress Report for Period Ending

July 31, 1974. Paik, N. C.; Davis, W.; Yarbrough, M. B.; Petras, D. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Nov 1974. Contract AT(11-1)-3045. 32p. AT.

Development activities involving the SPHINX-I and SPHINX-II cross section averaging codes for fast reactor calculations are reported. The SPHINX-I neutronics theory is treated in an appendix. (DG)

7562 THE FAST BREEDER PROJECT OF THE GERMAN FEDERAL REPUBLIC AND THE BENELUX STATES. Hueper, R. Nachr. Chem. Tech.; 21: No. 11, 231-233(1973). (In German). 1 tab.

The start of the building of the fast breeder nuclear power plant SNR 300 in Kalkar/county Kleve (Lower Rhine) in spring 1973 has introduced a new phase of a joint project of the Federal Republic and the Benelux countries. A report is given on the development and aim of the fast breeder project in connection with the general nuclear power plant development. (GE)

7563 FRENCH FAST REACTOR PHYSICS PROGRAM. Bussac, J. (CEN de Saclay, Gif-sur-Yvette, France); D'Orval, C. C.; Barre, J. Y.; Chaumont, J. Y.; Vidal, R. pp 9-35 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The work performed at the C.E.A. in the field of fast reactor physics is defined in the general framework of the fast reactor R & D program. The studies were mainly devoted in the past years to the PHENIX reactor design and start-up preparation. During the last two years, studies have been directed towards the problems concerning a 1200 MW(e) plant. Experimental programs are carried out on three critical facilities: MASURCA and HARMONIE at Cadarache, MINERVE, a fast-thermal coupled facility, at Fontenay-aux-Roses. In addition, measurements carried out on RAPSODIE-FORTISSIMO and from irradiated fuels or samples give particularly important information. Valuable information is also expected from the physical measurements planned during the PHENIX start-up. The main studies covered by the program deal with theoretical method developments, fundamental data and neutron spectrum measurements, experimental programs and their analysis (especially control rod problems), higher plutonium isotopes, burn-up, neutron propagation and gamma heating; the new Version 3 of the Cadarache multigroup cross section set is adjusted on these results. The trends of future studies required by the new features of the 1200 MW(e) commercial SUPERPHENIX plant are indicated. (FR)

7564 FAST REACTOR PHYSICS PROGRAM IN THE FEDERAL REPUBLIC OF GERMANY. Fischer, E. A.; Kuesters, H. (Kernforschungszentrum, Karlsruhe, Ger.). pp 36-60 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics and fast reactors; Tokyo, Japan (16 Oct 1973).

The fast reactor physics program in the Federal Republic of Germany is part of an R&D effort in the field of fast breeder reactors. The German program is coordinated and carried out in close cooperation with the programs in the Benelux countries. The major effort in the program to date has been oriented towards the development of the German-Benelux sodium cooled fast breeder prototype SNR-300. Some effort has already been devoted to larger fast breeders. The adequate prediction of physics parameters in fast reactors, in particular in the SNR-300, has been the principal objective in the program. This is accomplished by a combination of integral- and differential-measurements and computer code development. Target and presently-achieved accuracies in the predictions of these parameters are quoted. Fast integral measurements are carried out in both the critical facility SNEAK and the subcritical facility SUAK. In SNEAK the emphasis has been on the measurement of power traverses, control rod effects, and sodium void reactivities in a series of SNR-type compositions. Due to the shortage of plutonium, zoned techniques are used. This necessitated the study of several assemblies, each simulating different features of the SNR-300. Clean physics cores in simple geometry were also studied in SNEAK. Spectrum measurements in single-material assemblies constituted the SUAK program. Parts of both the SNEAK and SUAK programs were planned and conducted in cooperation with the group in Cadarache, France. Differential cross section measurement and evaluation activities have been directed toward the improvement and up-dating of the nuclear data file KEDAK and of the 26-group cross section sets used in routine calculations. Calculational method improvements have been realized in 2D S_n, 3D synthesis, Monte Carlo, core dynamics, and cell codes in the past few years. At present, major efforts are devoted to the completion of an advanced modular code system and to the development of excursion codes for accident analysis. Considerable attention is being directed toward the testing of available codes and cross section data through comparison of measured and calculated integral parameters. (auth)

7565 REVIEW OF THE FAST REACTOR PHYSICS PROGRAM IN JAPAN. Higashihara, Y. (Power Reactor and Nuclear Fuel Development Corp., Tokyo). pp 77-92 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The experimental fast reactor JOYO is under construction at O-arai Engineering Center and is to be critical in early 1975. The calculational models and cross section set (NNS-5) used in the reactor design were validated on the basis of analyses of mock-up critical experiments performed using FCA (JAERI) for two years ending in March 1972 and of neutron deep penetration experiments performed using YAYOI (U. of Tokyo). The design of the 300 MW(e) prototype fast breeder reactor MONJU is proceeding, and construction is scheduled to start early in 1975. The experimental program to support the reactor design consists of two activities: one making use of ZEBRA (MOZART Project, a joint program between PNC and UKAEA), and the other making use of FCA. Both activities are coordinated so as to make the experimental information complementary. Studies on the performance of the MONJU core and evaluation of design methods are underway based on analyses of these experiments. Emphasis is placed upon the evaluation and improvement of the current design methods in order to establish good statistics in extrapolation to the design. Reactivity effects of higher Pu isotopes, reaction rate distributions in breeder blankets, sodium removal and Doppler reactivity coefficients, and control rod reactivity worths are some highlights being attacked to improve the current design methods. In relation to the zoned mock-up experiments in FCA, interpretation and extrapolation of experimental information are studied by the generalized perturbation theory and the density coefficient method. Evaluation of nuclear data and improvement of processing methods of group constants are continued based on analyses of integral experiments using the 70-group and 25-group JAERI-Fast sets. Some recent features in the study of modeling and code development are utilization of two-dimensional transport and three-dimensional diffusion codes in fast reactor calculations, development of special codes for experimental analyses, and development of a modular code system. Development of burnup analysis methods is being made based on three-dimensional diffusion theory supported with experimental information obtained from irradiated fuel samples and later on from JOYO operation. The topics are summarized in the categories of the development of experimental and theoretical programs, status of the calculational capabilities, and program planning. (auth)

7566 OUTLINE OF THE ITALIAN FAST REACTOR PHYSICS ACTIVITIES. Pierantoni, F. (ed.). (Comitato Nazionale per l'Energia Nucleare, Bologna). pp 61-76 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The fast reactor physics research program is briefly surveyed. Topics covered are: (1) nuclear data, (2) calculation methods for criticality evaluation, (3) shielding problems, and (4) experimental facilities. Work planned for the future is also outlined. (auth)

7567 REVIEW OF THE UK FAST REACTOR PHYSICS PROGRAM. Campbell, C. G. (Atomic Energy Establishment, Winfrith, Eng.). pp 93-104 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The developments which have taken place in recent years with respect to predicting the nuclear performance of sodium-cooled plutonium-fuelled fast reactors of the sizes of PFR and CFR are briefly reviewed. Consideration is given both to uniformly loaded cores and to the nonuniform loadings typical of those which will arise in PFR operation. The physics uncertainties associated with the prediction of parameters for CFR design and operation are discussed together with the program of experiments to reduce those identified. (auth)

7568 REVIEW AND SUMMARY OF THE U. S. REACTOR PHYSICS PROGRAM. Hannum, W. H. (Atomic Energy Commission, Washington, DC). pp 105-121 of Proceedings of the Inter-

national Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The U. S. reactor physics program is a highly organized part of the U. S. AEC's civilian power reactor development program. A number of unique facilities have been designed and built for this specific mission and are being used in a direct manner to develop a design base of quantifiable reliability and efficiency for reactor design, encompassing nuclear data, methods, and integral experiments. The cross section program is characterized by the Evaluated Nuclear Data File, Version B, and the Cross Section Evaluation Working Group approach. This program has produced files for reliable reactivity prediction for fast reactors of demonstration plant size. Major efforts are under way to extend the file in a number of directions: fission products (yields, cross sections, decay energies, half-lives, delayed neutrons; gamma production and transport; reaction cross sections for dosimetry and radiative damage applications; cross section error files; cross section standards and shielding files; and improved overlap with other specialties. In addition, review and testing continue to reveal inconsistencies, canceling errors, and overoptimistic reporting by measurers which restrict the range of confidence in these files. The methods development work has achieved a consolidation of effort and a corresponding common use of reference codes. Effort is now being directed toward replacement of the component parts of the computer analysis sequence. Substantial progress has been made in upgrading the tools for group cross section generation (MC^2-II, MINX). In addition, there is considerable interest in the application of finite element, rather than finite difference, methods so as to obtain a substantial improvement in effective capability. Sound components for a good Monte Carlo approach including combinatorial geometry, biasing, unresolved resonance treatments, etc., are in hand. A well documented Monte Carlo code is not yet available. Interfaces are defined, and work is under way in obtaining generally useful fuel cycle codes. The planned use of power reactors to provide input to the confirmation of LMFBR nuclear design data and methods in the U. S. has been largely limited to SEFOR. Efforts are underway to couple EBR-II observations more closely to LMFBR design. (auth)

7569 THEORETICAL AND EXPERIMENTAL RESEARCH ON FAST REACTOR PHYSICS. Orlov, V. V.; Kazanskii, Yu. A.; Nikolaev, M. N.; Troyanov, M. F. (State Committee for the Utilization of Atomic Energy, Obninsk, USSR). pp 122-136 of Proceedings of the International Symposium on Physics of Fast Reactors, Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

A survey of theoretical and experimental work on fast reactor physics is given. Main trends of investigations in the fields of nuclear constants, calculational methods for fast power reactors, experiments on critical assemblies, and power reactors are considered. (auth)

7570 EVALUATION OF DESIGN METHODS BY ANALYSES OF MOCK-UP EXPERIMENTS. Zukeran, A. (Power Reactor and Nuclear Fuel Development Corp. Tokyo); Katsuragi, S.; Hirata, M.; Iijima, S.; Yamamoto, M. pp 371-395 of Proceedings of the International Symposium on Physics of Fast Reactors, Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Systematic analyses of the integral experiments made in ZEBRA under the MOZART project and FCA have been performed in order to establish a reliable calculational method including cross section sets for core design. Emphasis is placed on evaluation of the applicability of conventional design methods by the analyses of criticality, power distribution, sodium void reactivity worth, sample reactivity worth, density coefficient, and control rod worth. Correlation of results obtained by several participants has been carried out. The cross section sets used in the analyses are the JAERI-Fast set and five Bondarenko type sets. Accuracy of criticality calculations was in the range from −0.52 to 1.2% Δk. The calculated power distribution agreed well with that estimated from measured reaction rate distributions and central spectrum indices. The deviation of calculated power distribution from that of experiment was about −6.8% at the middle point of MZ-B(2) radial blanket. The control rod worths were predicted within ± 10% Δk/k for overall single rods. (auth)

7571 FAST REACTOR PHYSICS AT CEA. Barre, J. Y.; Bouchard, J.; Caumette, P.; Desprets, A.; Hammer, P. (CEN de Cadarache, Saint-Paul-les-Durance, France). pp 396-428 of Proceedings of the International Symposium on Physics of Fast Reactors, Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

At CEA, the studies devoted to the characteristics of the "clean core", defined as a core that is not influenced by higher plutonium isotopes or burn-up problems, are divided in two parts: analyses of the neutron balance in the lattice cell; and studies of "design" parameters, such as power distributions, blanket parameters, and control rods. Among the neutron balance parameters, the first priority is given to the material buckling, the production over absorption ratio, and the reaction rate ratios. The cores R (Uranium) and Z (Plutonium) with variable enrichment and constant Sodium diluent represent the basis of the neutron balance studies. The lattices HUG-PHUG and PHRIXOS concern either variable graphite pitches or variable enrichment. A third program deals with "$k_\infty = 1$" lattices either poisoned with Boron (cores KU-KP) or of low enrichment (cores OP and UK). Irradiation experiments study mainly the fissile isotope capture data. Programs have been carried out at MASURCA and HARMONIE (CADARACHE), at ERMINE (FONTENAY-AUX-ROSES) and also at SNEAK in the frame of the close cooperation involved with KARLSRUHE. The main points of the experimental techniques applied to these programs and the obtained accuracies are described. The techniques of analysis, the influence of the theoretical approximations, and the comparison of values measured and calculated with the CADARACHE multigroup cross section set are presented. The main consequences drawn from the comparisons for the PHENIX and SUPER PHENIX Reactors are reviewed, together with future plans. (auth)

7572 U. S. FAST INTEGRAL EXPERIMENTS PROGRAM. Amundson, P. I.; Bennett, E. F.; Carpenter, S. G.; Kato, W. J.; LeSage, L. G. (Argonne National Lab., IL). pp 431-463 of Proceedings of the International Symposium on Physics of Fast Reactors, Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The U. S. fast reactor program has developed an integral experiment capability whose purposes are: (1) to provide the integral data required to establish calculational methods and a reliable differential nuclear data base, (2) to verify nuclear parameters of specific reactor designs, and (3) to identify by experiment unforeseen problems in reactor design. The facilities used in the program include Argonne National Laboratory's (ANL) ZPR-6, ZPR-9 and ZPPR for Clinch River Breeder Reactor benchmark experiments and FFTF design oriented critical experiments; Massachusetts Institute of Technology's (MIT) Blanket Test Facility (BTF) for LMFBR blanket studies; Aerojet Nuclear Company's (ANC) Coupled Fast Reactivity Measurement Facility (CFRMF) for highly radioactive fission product reaction cross section measurements; and Oak Ridge National Laboratory's (ORNL) Tower Shielding Facility (TSF) for deep penetration and design mockup shielding studies. As a result of the integral experiment program there is generally reasonable agreement between measured and calculated values for such parameters as k_{eff}, power distributions, and reaction rate measurements. Remaining problem areas are sodium-void coefficients in large plutonium fueled fast reactors, effects of the higher isotopes of plutonium on reactivity, power distribution and control rod worths, effects of spatial power distortions due to varied control rod patterns, and central worth discrepancies. (auth)

7573 EVALUATION OF FISSION SPECTRA AND CROSS SECTIONS BY ZERO-LEAKAGE CORE EXPERIMENTS. Iijima, T.; Mukaiyama, T. (Japan Atomic Energy Research Inst., Tokai). pp 520-536 of Proceedings of the International Symposium on Physics of Fast Reactors, Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

A series of unit k_∞ core experiments was performed at FCA to obtain information on the equivalence of ^{239}Pu to ^{235}U in fast reactors, and to examine the inelastic slowing down cross section of ^{238}U. Three assemblies were built. Each assembly consists of a test zone (about 44 l) of nearly unit k_∞, a 20% enriched uranium driver and a natural uranium blanket. Assembly IV-1 (first built in 1969 and rebuilt in 1972) is an all uranium system, and Assemblies IV-1-P, IV-1-P' have a plutonium/natural uranium test zone. Three assemblies are nearly the same from the view-point of the slowing down cross section in the main energy region of the neutron spectrum, since ^{238}U occupies most of the composition. The main difference between Assembly IV-1 and the latter two is the difference in the fissile material. Fission rate ratios and k_∞ values were measured to obtain knowledge of the fission spectra and cross sections important for criticality. In order to evaluate the inelastic slowing down cross section of ^{238}U, neutron spectra were measured by various methods. The analysis was done with four cross section sets. The agreement of k_∞ values between the

experiment and the calculation is unsatisfactory, especially for Pu/NU systems. From the change of fission ratio $^{239}\sigma f/^{235}\sigma f$ between IV-1 and IV-1-P', the ratio between the average energies of fission neutrons of ^{239}Pu and ^{235}U is determined. This result shows that ^{239}Pu and ^{235}U are equivalent as far as the effect of the fission spectrum on reactor properties is concerned, and it agrees with some of the results of other integral experiments, but is inconsistent with the value of 1.08 obtained by differential measurements. (auth)

7574 GROUP CONSTANTS SET OF FISSION PRODUCTS. Kikuchi, Y.; Tasaka, K.; Nishimura, H.; Hasegawa, A. (Japan Atomic Energy Research Inst., Tokai). pp 645-664 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The Japanese Nuclear Data Committee has evaluated the data of fission product nuclides since 1970. At the first stage, 28 important nuclides were selected considering their large macroscopic cross sections in the equilibrium core of fast reactors, and the main efforts have been devoted to the evaluation of these important nuclides. This evaluation work was completed in March, 1973. While this evaluation proceeded, the FP data files already evaluated in other countries were examined. A set of group constants were produced from data previously evaluated elsewhere in order to understand the problems in processing FP cross section data and also to respond to urgent requests from users. At the completion of the evaluation by JNDC, these evaluated data were also processed to the multi-group constants. Thus two sets of FP group constants were generated. The group constants of FP nuclides are of the same group structure as the JAERI-Fast Set with 25 or 70 groups. The group constants of each nuclide were lumped to those of a pseudo FP nuclide at various stages of burn-up, using the concentrations as weights. The concentrations were calculated by solving the beta-decay schemes with the independent yield data. The lumped capture cross section of JNDC group constants set is about 25% larger than that of the foreign set when collapsed to one group with the spectrum of a typical large fast reactor. The effects of these differences between two sets on the reactor characteristics were investigated for two typical fast reactors; a 1500 MW(e) commercial FBR and a 300 MW(e) prototype FBR. The difference of the reactivity life is about 10% and that of the effective multiplication factor is about 0.6% which causes a change of 3.5% for the core volume and a change of 1.4% for Pu enrichment for both reactors. The effect on the sodium void coefficient is about 10% for the 1500 MW(e) FBR. Hence the uncertainties of the FP group constants significantly affect the reactor design. (auth)

7575 SYSTEMATIC ERRORS IN THE CENTRAL REACTIVITY COEFFICIENTS. Karam, R. A. (Georgia Inst. of Tech., Atlanta); Kato, W. Y. pp 1007-1032 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Systematic errors responsible for the large discrepancy between measured and calculated central reactivity coefficients were examined. These errors were narrowed to two sources: the normalization integral (or perturbation denominator) and the conversion factor of inhour, or dollars, to $\Delta k/k$ units. The magnitude of both sources of error is uniquely determined by the ratio of the measured-to-calculated normalization integral (NI) when the measurement is carried out using the ^{252}Cf source-reactivity method. The measured-to-calculated NI ratio for ZPR-6 Assemblies 6A and 7, two typical demonstration plant Liquid Metal Fast Breeder Reactor criticals, were 1.19 and 1.21, respectively. The magnitude of this discrepancy is essentially the same as that found for the central reactivity coefficients. Analysis of the available fission rate distribution in both assemblies indicates that the calculated NI may be underestimated by 6-8% and the remainder of 10-14% must come from the conversion factor. Some delayed neutron data, when used with the appropriate average number of neutrons per fission in each assembly, yield conversion factors 9-13% higher than other delayed neutron data. This would provide the explanation for the central reactivity discrepancy. Recent measurements of β_{eff} at different laboratories indicated that the calculated values are underpredicted. Measurements performed at Karlsruhe showed that the calculated β_{eff}, using other delayed neutron data, was underpredicted by 14%. (auth)

7576 MEASUREMENTS AND ANALYSIS OF THE DOPPLER EFFECT OF STRUCTURAL MATERIALS. Ishiguro, Y.; Mukaiyama, T.; Iijima, T.; Takano, H. (Japan Atomic Energy Research Inst., Tokai). pp 964-983 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The Doppler effect of structural materials has been studied at JAERI, and its importance in fast reactor safety has been emphasized. A summary of the study is presented. The new Doppler experiment of the structural materials was performed in FCA Assembly VI-1 (MONJU mockup). The method used is based on measuring the reactivity changes which result from heating a small Doppler sample. By oscillating the sample and the reference material to be placed at the core center alternately, the reactivity drift is eliminated, and a precision of 10^{-7} $\Delta k/k$ is achieved when the reactivity changes are determined. This experimental result shows that the Doppler effect due to the structural materials is much larger, compared with those formerly observed in the smaller FCA cores. That is, the Doppler coefficients observed for stainless steel and natural iron were more than 20% of the negative ^{238}U coefficient. The contributions from the structural materials to the Doppler effect are concluded to be more significant than those from higher isotopes such as ^{235}U, ^{239}Pu, or ^{240}Pu and therefore are expected to play an important role in fast reactor safety. From the viewpoint of the Doppler effect calculation, a study was made to grasp the present situation of the nuclear data of the structural materials in the KeV energy region. The experimental results of the Doppler coefficient formerly reported were also taken into account for this study. There are two important energy regions which mainly contribute to the Doppler effect; one is the vicinity of the most important capture resonance (Er = 1.15-KeV) of ^{56}Fe and another is the energy range from 20 to 50-KeV. It is concluded that a precise evaluation is needed for the resonance parameter of the 1.15-KeV resonance of ^{56}Fe and for the background capture cross sections of Fe and Cr in the energy range from 20 to 100-KeV. (auth)

7577 FUEL MANAGEMENT FOR LARGE FAST REACTORS. Thornton, D. E. J.; Burstall, R. F.; Leslie, R.; Ball, M. A. (UKAEA Reactor Group, Risley, Eng.). pp 790-813 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

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The cost of supplying fuel to a reactor over its life is, in present worth terms, an appreciable fraction of the capital cost of the entire power plant, and it is therefore important to ensure that a carefully thought out refueling strategy is adopted which extracts the maximum benefit from all fuel charged. A good deal of work has been carried out on this problem in the United Kingdom, though the application to fast reactors is of relatively recent development. The methods devised to examine the problem are briefly reviewed, and some results of recent studies are presented. The central calculation in fuel management work is a determination of rating distribution and reactivity, and this calculation is repeated a great many times as the core state changes through burnup, refueling, and control rod movement. A rapid flux/reactivity calculation is therefore essential, and various simplifying assumptions are adopted to speed up the calculation and to lessen the amount of input data needed. Since these are far-reaching simplifications, a number of calculations are presented which show that no serious inaccuracies arise from their use. The Fortran computer program CRACKLE, which embodies these simplifications, has been written and used in the investigation of a number of possible refueling schemes for a large fast reactor. (auth)

7578 DEVELOPMENTS TOWARD AUTOMATED FUEL MANAGEMENT SCHEMES. Wheeler, R. C. (UKAEA Reactor Group, Dounreay, Eng.). pp 814-836 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Fully automated tactical fuel management codes are likely to be developed in the next few years. If, as seems likely, economic operation is the criterion by which plans are selected, (perhaps after the core loadings have first included a development program of non-standard sub-assemblies, which may not be amenable to a strict economic approach), then the main stages are likely to be: (1) generation of trial plans using approximate but rapid methods, (2) economic assessments of above, with elimination of many trial plans, (3) diffusion theory checks on a limited number of plans only, and (4) recycling to (1). How this scheme might be applied to the PFR is discussed. Some progress is reported with item (1) above, in which indications are that adequate accuracies in pre-

dicting changes to reactivity and flux distributions may be achieved without diffusion theory by using libraries of data derived by diffusion theory. Reactivity changes can be correlated with position, flux, and burn-up to give good agreement with calculations for both symmetric and "tilted" flux distributions, and are additive for multiple exchanges. Flux changes can be related simply to the reactivity changes at each position and are multiplicative for multiple exchanges. Examples in 2D and 3D are given. (auth)

7579 PRINCIPLES OF REFUELING PROGRAM DESIGN FOR STEADY-STATE AND TRANSIENT CONDITIONS OF THE BN-350 REACTOR. Matveev, V. I.; Mamaev, V. V.; Koloskov, B. V. (State Committee for Utilization of Atomic Energy, Obninsk, USSR). pp 837-857 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The refuelling scheme for the core fuel assemblies of the BN-350 reactor is studied. General discussions on the requirements for three types of refuelling schemes, namely zonewise partial refuelling, uniform partial refuelling, and partial refuelling with transposition, are given from the viewpoints of average burnup of discharged fuel, discharge regularity, and power flattening. The selection of time interval between refuelling is also discussed. The method of bringing the reactor to mean steady state conditions is discussed. A uniform partial refuelling scheme with 5 subzones and a 54 day refuelling interval was adopted. The details of the selected scheme are given in tables. The average burnup rate of discharged assemblies is 3.5%. The exchange of control rods is also considered. Each one stays in the core for 6 refuelling cycles. The refuelling scheme for transient condition is analyzed and discussed from the viewpoint of discharge burnup. To attain complete burnup, the reuse of discharged assemblies is taken into account. (JA)

7580 RETRIEVAL OF REACTIVITY COEFFICIENTS FROM EFFBR ON-LINE OPERATING DATA. Stievenart, M.; Bouffioux, P. (Belgian Society for Nuclear Industry, Brussels). pp 139-151 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The Enrico Fermi Fast Reactor (EFFBR) has been practically the only reactor equipped with a process computer capable of on-line checking of the reactivity balance. Some available on-line measurements were used to test off-line methods of retrieval of reactivity coefficients for the purpose of evaluating the possibility of updating the reactivity coefficients in on-line reactivity balance monitoring. Several methods were used successfully and yielded several sets of EFFBR reactivity coefficients whose differences are discussed in the paper. A comparison of these coefficients with values obtained by standard techniques was also performed, and the discrepancies are discussed. (auth)

7581 EBR-II PHYSICS EXPERIENCE. Meneghetti, D.; Loewenstein, W. B. (Argonne National Lab., IL). pp 175-199 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The physics analyses of EBR-II loadings, operations, modifications, tests, and of environmental characteristics of each subassembly require extensive usage of current methods of analyses and also development and innovation of techniques. This is due to the heterogeneous complexity of the system, the frequent loading changes,and the user need for detailed environmental characterization. Adaptation and utilization of two-dimensional discrete-transport methods have been extensively applied to both neutronics and gamma analyses of the heterogeneously-loaded EBR-II cores having both the former depleted-uranium-type blanket and the recently installed steel-rich reflector. These analyses require close coupling and iteration with appropriate thermal-hydraulic models. Analytical studies for specific environmental tailoring of neutron and gamma levels for particular experimental subassemblies have been made. A burnup and fluence history for the subassemblies in the EBR-II core and blanket regions has been underway, beginning with EBR-II Run No. 1. The understanding of the reactor behavior at power requires a monitoring of the integral responses on both long-term and short-term bases. The former comprise principally the reactivity required to bring the reactor from zero to full power and the reactivity required to remain at power. The latter information is generally routinely obtained using rod oscillator and rod-drop methods as augmented by an analog reactivity meter and various programs for real-time digital data analysis. The latter include a post incident recall system. Monitoring of coolant temperature and flow information provides insight to the unfolding of neutronic behavior. (auth)

7582 SOME PHYSICS CHARACTERISTICS OF THE BOR-60 REACTOR. Gryazev, V. M.; Krasnoyarov, N. V.; Kevrolov, V. P.; Afanasiev, V. A.; Efimov, V. N. (Scientific-Research Inst. of Atomic Reactors, Dimitrovgrad, USSR). pp 200-214 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The results are given on the calculation and experimental investigations of some critical parameters, of the control and safety rod efficiencies, and of some changes in excess reactivity in the BOR-60 reactor with different core compositions of fuel and experimental subassemblies. Irradiation of special enrichment samples were made. Fission and capture rates for ^{235}U and ^{238}U were measured; the spectral indices being defined as well. The measurements of the power density distribution in the reactor core were carried out according to the residual gamma-activity of the irradiated fuel elements and pellets. The height nonuniformity coefficient changed from 1.8 in the core center to 1.09 at its boundary. The coefficient K_Z averaged along all the core cells was 1.13 (calcul. 1.12). The radial coefficient K_R was 1.10. The results are given on the measurements of residual power of fuel subassemblies after the reactor shutdown and compared to those obtained for the fission spectrum. It is shown that under the operating conditions at maximum power density (1100 kW/1), the residual power of the subassembly with the burnup up to 10% doesn't exceed 500 W in 17-18 days after shutdown, which permits reloading in argon atmosphere without any forced cooling. The reactivity effect experimental investigations are continuously carried out at all the operating stages of the BOR-60 reactor with sodium coolant. The investigated range of parameter changes is as follows: in power, from a minimum controllable level to 50 MW at coolant heating up to 230°C; in coolant flowrate along the reactor, from 300 to 1000 m^3/h; in inlet coolant temperature from 240°C; in fuel, from the initial structure to one corresponding to 10% burnup; a maximum heat power density is 1100 kW/1. (auth)

7583 PHYSICS TEST PROGRAM AT THE START UP OF PHENIX. Clauzon, P. P. (CEN de Cadarache, Saint-Paul-les-Durance, France); Boyer, J.; Gourdon, J.; Humbert, J.; Martin, J. F. pp 215-239 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The physics test program at the start up of Phenix is presented. The main objectives were the following: (1) to verify the safety characteristics of the plant, (2) to allow the operating staff, by a good knowledge of the physics of the reactor, to plan correctly the successive loading patterns, the fuel management, and to well characterize the irradiations, and (3) to allow the project designers to test the codes and basic data used. The measurements made are expected to be of assistance in the following tasks: determining the correct enrichments of fuel for future fabrications, determining the power distributions (very important in the case of multizoned cores), verifying the control rod worth and eventually correcting the 10B enrichment, and measuring the reactivity temperature coefficient and the Doppler coefficient. (auth)

7584 CRITICAL SIZE AND CENTRAL REACTION RATE RESULTS FROM THE MOZART PROGRAMME AND THEIR PREDICTIONS. Ingram, G. (Atomic Energy Establishment, Winfirth, Eng.). Stevenson, J. M.; Smith, R. W.; Ichimori, T.; Konishi, T. pp 240-255 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Calculations of k_{eff} and central fission and capture reaction rates have been made for the MONJU mockup assemblies at ZEBRA, MZA and MZB, using the FGL5 data set in diffusion theory with supplementary studies in transport theory. The basis cell calculations have been made using the MURAL code to condense to 37- and 9-group data, and the influence of cell representation has been studied. In the k-calculations using the GOG (diffusion theory) and DOT (transport theory) calculations a careful study has been made on the effects of mesh size, the order of Sn approximation, and group structure. The calculated values have been compared with the measured excess reactivity for the clean calculational model and the within-cell reaction rates measured by foil activation, fission chamber, and solid state track recorder techniques. (auth)

7585 INVESTIGATION OF THE BN-350 REACTOR PHYSICS CHARACTERISTICS. Orlo, V. V.; Pomerantsev, G. B.; Yurchenko, D. S.; Vasilenko, K. T.; Doubovskii, B. G. (State Committee for Utilization of Atomic Energy, USSR). pp 240-256 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Experimental results for physics characteristics of the BN-350 fast power reactor are given. The reactor reached criticality on November 29, 1972. The experimental data obtained are compared with theoretical results. (auth)

7586 SCOPE OF THE MOZART PROGRAM AND THE GENERAL CONCLUSIONS DRAWN FROM IT. Campbell, C. G. (Atomic Energy Establishment, Winfrith, Eng.); Sanders, J. E.; Rowlands, J. L.; Kobayashi, S. pp 259-268 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The overall scope of the joint AEA/PNC program of full mock-up experiments for MONJU undertaken at ZEBRA are reviewed, and the assemblies chosen for the MOZART work are described. Attention is drawn to those experimental results which are not adequately predicted by multigroup diffusion theory methods, and improvements to methods needed to provide adequate predictions are outlined. Results for which further interpretational work is needed are discussed. (auth)

7587 REVIEW OF THE REACTION RATE SCAN DATA FROM THE MOZART EXPERIMENTS. Ingram, G. (Atomic Energy Research Establishment, Winfrith, Eng.); Hardiman, J. P.; Smith, R. W.; Konishi, T.; Nakano, M. pp 289-311 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Extensive radial and axial reaction rate scans using foil activation and fission chamber techniques have been made in the MONJU mockup assemblies at ZEBRA, MZA and MZB. In the MZB assembly three different compositions of the blanket in one 90° sector were studied containing natural UO_2/sodium, depleted UO_2/sodium and uranium/carbon/sodium. Activation foils were loaded into special plates forming parts of the normal lattice cells in the various core and blanket regions. A study was made of the spectrum-dependence of gamma ray yield per fission required for interpretation of foil data in different regions. Small fission chambers were traversed across major axes using a computer controlled scanning system. Streaming effects along the scanning tube were estimated experimentally and by calculation. The measured scans are compared with 37 group diffusion theory and the influence of calculational approximations has been studied. Fundamental mode bucklings were derived from the MZA scans. The interpretation of measurements near region boundaries has required a number of subsidiary experimental and theoretical investigations. Transport theory is found to give improved agreement with experiments at the core-blanket interface but discrepancies still remain in the prediction of the fission rate attenuation throughout the blanket regions. (auth)

7588 MOZART SODIUM REMOVAL EXPERIMENTS AND THEIR INTERPRETATION. Stevenson, J. M. (Atomic Energy Establishment, Winfrith, Eng.); Hardiman, J. P.; Yoshida, H. pp 312-334 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The reactivity changes following sodium removal from the MONJU mockup assemblies at ZEBRA, MZA and MZB, have been measured by compensating movements of a fine control rod. Sources of experimental error due to temperature drifts, lack of dimensional reproducibility etc. are assessed. The measurements in MZA were confined to different axial regions of the central channel while in MZB the measurements were extended to cover a range of radial positions in the core and blanket. Comparisons of voiding effects in plate and pin geometry have been made, the latter being achieved by loading PuO_2/UO_2 pins into calandria with and without sodium. The experimental results are compared with prediction using the FGL5 data. Cross-sections for the normal and voided cells are obtained using the MURAL code and used in direct k-calculations in diffusion theory and also in perturbation calculations which permit a breakdown into the different components contributing to the reactivity changes. (auth)

7589 REVIEW OF THE CENTRAL AND DISTRIBUTED PERTURBATION EXPERIMENTS IN THE MOZART PROGRAM. Stevenson, J. M. (Atomic Energy Establishment, Winfrith, Eng.); Yoshida, H. pp 335-354 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Central cell perturbation experiments were made in the MONJU mockup assemblies at ZEBRA, MZA and MZB. Samples were introduced in the normal cell plate geometry to avoid the interpretational problems associated with the use of cavities. Materials studied including plutonium of various isotopic compositions, ^{235}U, natural and depleted UO_2, boron, sodium, steel and tantalum, and a unit cell of the core medium. Reactivity changes were measured by the change in critical balance point following replacement of normal by perturbed cells using a motorized sample changer. The central worths are compared with prediction using the FGL5 data in MURAL calculations for the normal and perturbed cells. In MZB measurements were made of the worths of uniformly perturbed fuel elements at a range of radial positions in the inner and outer core and of the influence of plutonium-build-up in the blanket. Comparisons are made with first-order perturbation calculations in three-dimensional diffusion theory. As a test of the accuracy of calculation of the worth of edge fuel used to balance the control rod addition in MZC, an experiment was conducted in which the reactivity loss from uniformly distributed depletion of the inner core zone was compensated by replacing PuO_2/UO_2 plates with UO_2 plates. The results of this measurement coupled with the central cell experiments allow a comparison of reactivity scales based on the inhour equation (evaluated delayed neutron data), central plutonium worth, distributed inner core depletion, and edge fuel worth. (auth)

7590 USE OF INTEGRAL EXPERIMENTS TO IMPROVE NEUTRON PROPAGATION AND GAMMA HEATING CALCULATIONS. pp 486-505 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Studies to define and improve the accuracies of neutron propagation and gamma heating calculations from integral experiments encompassed in the field of the fast reactor physics program at CEA are briefly reviewed. A systematic analysis of neutron propagation in Fe-Na clean media, with variable volumic composition between 0 and 100% in sodium, has been performed on the HARMONIE source reactor. Gamma heating traverses in the core, the blankets, and several control rods have been measured in the R Z core program at MASURCA. The experimental technique, the accuracies, and the results obtained are given. The approximations of the calculational methods used to analyze these experiments and predict the corresponding design parameters are also described. Particular emphasis is given to the methods planned to improve fundamental data used in neutron propagation calculations by using the discrepancies observed between measured and calculated results in clean integral experiments. One of these approaches, similar to the techniques used in core physics, relies upon sensitivity studies and eventually on adjustment techniques applied to neutron propagation. (auth)

7591 RECENT PROGRESS IN FAST INTEGRAL EXPERIMENT AND ANALYSIS AT FCA. Hirota, J.; Kuroi, H.; Iijima, T.; Mizoo, N.; Shirakata, K. (Japan Atomic Energy Research Inst., Tokai). pp 506-519 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

A series of mock-up experiments for the Prototype Fast Breeder Reactor MONJU was started at FCA in August 1972. Two assemblies of zoned loading, named VI-1 and VI-2, have been constructed as the physics mock-up; the test regions of Assembly VI-1 and VI-2 simulate the outer core and the inner core of MONJU. The test region is radially surrounded by the driver region fueled with enriched uranium. The axial length of the test region and the driver region are equal to that of the core of MONJU. A study of the criticality has been made including the heterogeneity effect due to the plate structure. The experiment revealed that the interaction of the plutonium plates with the depleted uranium oxide plates is important to the bunching effect. A method, called the Density Coefficient Method, has been applied which was developed to predict experimentally the criticality of an unknown reactor. As to the reactivity coefficients, it is concluded that a disagreement which existed between calculated and measured values of the central sodium void effect can be removed

by the use of the adjusted cross section library AGLI of 1950 group structure. The full mock-up experiments for MONJU were carried out at ZEBRA under collaboration between the UKAEA and PNC; MZ-A, MZ-B and MZ-C. A study of the correlation between integral data obtained on the partial and full mock-up systems (assemblies VI-1, VI-2 and MZ-A, MZ-B) is being made. The code system DOYC with AGLI is used throughout the analysis. The two dimensional S_n or diffusion approximation is used. The study shows how the results obtained on the partial mock-up system contribute to improvement of the reliability of predictions for large fast reactors. (auth)

7592 INVESTIGATION OF THE BN-600 REACTOR MODEL AT THE BFS-2. Orlov, V. V.; Averin, L. V.; Avramov, A. M.; Bondarenko, V. V.; Gerasimov, P. V. (State Committee for Utilization of Atomic Energy, Obninsk, USSR). pp 571-600 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

A number of critical systems simulating the Beloyarsk-3 reactor at different operation stages were assembled at the BFS-2 in 1971-1972. These critical assemblies were used for studying critical parameters, heat release distribution, the efficiency of control rod mock-up, burn-up compensation system efficiency, boron compensator interference, differential and total sodium void reactivity effects and the reactivity effect caused by substitution of aluminium for sodium. The experimental and calculated data are compared, and an evaluation of accuracy in prediction of physical characteristics of the Beloyarsk-3 fast reactor is made. (auth)

7593 EXPERIENCES WITH STEK: DERIVATION OF FISSION PRODUCT CROSS SECTIONS AND THEIR IMPROVEMENT BY STATISTICAL ADJUSTMENT USING SAMPLE REACTIVITY WORTHS. Bustraan, M.; Dragt, J. B.; Gruppelaar, H.; Heyboer, R. J.; Janssen, A. J. (Stichting Reactor Centrum Nederland, Petten). pp 665-682 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Reactivity worth measurements have been performed in the coupled fast-thermal critical facility STEK, with the aim to check and improve fission product group cross sections for fast breeders. Mixtures of fission products as well as isotopic samples have been oscillated in the central fast zone of STEK. Measurements in four different fast neutron spectra, corresponding to $C/^{235}U$ atomic ratios of 72, 47, 35 and 23, have been completed. The composition of the samples was determined by means of chemical analyses. Problems were encountered with packing of the samples, especially in getting the materials free of hydrogeneous compounds. This was eventually achieved by a careful drying and packing procedure. The existing fission product capture cross section sets are reviewed. The present study is mainly based on the 26 group RCN-1 set for 75 fission product isotopes. Statistical errors in the group cross sections and their correlations based on uncertainties in resonance parameters, nuclear level statistics, and nuclear model errors have been calculated. This error calculation is needed for the adjustment calculations. Since an accurate knowledge of the neutron spectrum is indispensable, several neutron spectrometry techniques have been applied, viz. triple foil technique, time-of-flight method, proton recoil technique, and measurements with a ^3He proportional counter and with ^6Li sandwich solid state detectors. In addition, several fission rate ratios were obtained either by foil activation or with an absolute double fission chamber. All results are combined in an adjustment calculation. The group cross sections of the isotopes of the RCN-1 set and their errors have been combined to group cross sections of both the integral samples and the pseudofission products, together with their statistical errors, including the covariances between cross sections of integral samples and pseudofission products. If the cross sections of the integral samples are now adjusted within their error margins in such a way that calculated reactivity worths fit the measured data of the three samples in all STEK spectra, the cross sections of the pseudofission products will automatically follow due to these covariances. Results of measurements and calculations are presented. Resulting accuracies of fission product effects in SNR-300 are given. The pseudofission product cross sections based on the RCN-1 set as presented in the report are recommended for fast reactor calculations. (auth)

7594 NEW EVALUATION OF NUCLEAR DATA FOR $^{240,241,242}Pu$. Caner, M.; Yiftah, S.; Shatz, B.; Meyer, R. (Soreq Nuclear Research Center, Israel). pp 683-702 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The isotopic composition of the plutonium produced as a by-product in thermal reactors, which is to serve as fuel for fast reactors, is typically in the following range: Pu-239, 50-65%, Pu-240, 20-25%, Pu-241, 10-15%, Pu-242, 5-10%. This means that for a typical 1000 MW(e) fast reactor fuelled with about three tons of plutonium, almost half, or 1.5 tons, may consist of higher plutonium isotopes. This simple statement emphasizes the importance to have data files which reflect the latest available experimental information and evaluated data for these isotopes. Current data files for Pu-240, Pu-241 and Pu-242 are based on data prior to the following dates: KEDAK, 1967; ENDF/B-III, 1968 for Pu-240, 1970 for Pu-241, 1967 with resonances revised in 1971 for Pu-242. New experimental data are available on resonance parameters and fission cross sections. In addition, there are new measurements of the total and scattering cross sections of Pu-240 in the keV range. A new evaluation of nuclear data for Pu-240, Pu-241 and Pu-242, based on the new experimental information and nuclear model calculations, has been performed. The numerical data have been incorporated into the new KEDAK file. The most significant data are reviewed and compared with the ENDF/B-III file and with the pre-1967 evaluation forming part of the KEDAK file. Discrepant data and parts of the evaluations based on nuclear model calculations are emphasized. (auth)

7595 THREE-DIMENSIONAL BURN-UP CALCULATION IN FAST REACTORS. Takeda, S.; Takeda, R.; Kobayashi, T. (Hitachi Ltd., Kawasaki, Japan). pp 745-766 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

A new program for 3-dimensional LMFBR burn-up calculations has been developed. The program is particularly useful in detailed analysis of burn-up physics and has convenient functions for LMFBR design. The preliminary 3-D burn-up calculations in a prototype reactor are compared with 2-D calculations. The detailed space dependent burn-up characteristics in the prototype fast reactor were made clear. The effect of control rods on the power distribution of each assembly is demonstrated by the 3-D method. It is planned to analyze LMFBR burn-up data using the program in the near future. Some problems remain in improving the program: (1) the increase of mesh points or the introduction of the triangular option, (2) the improvement in the acceleration of iterative convergence for the hexagonal coordinate finite difference diffusion equation, and (3) the improvement in the accuracy of the cross sections of fission products and Pu higher isotopes. (auth)

7596 INVESTIGATION OF THE HETEROGENEITY EFFECT IN SODIUM VOID REACTIVITY MEASUREMENTS. Fischer, E. A.; Helm, F.; Jourdan, G.; McGrath, P. E.; Oosterkamp, W. J. (Kernforschungszentrum, Karlsruhe, Ger.). pp 945-963 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

One of the major contributions to the total amount of reactivity that must be covered by the safety system of a fast reactor is the maximum sodium void reactivity effect. To investigate this effect a series of sodium void experiments were performed in a two zone core built in SNEAK, of which the inner zone corresponded to a mockup of the SNR-200. These experiments were analyzed with heterogeneous computer programs to study the adequacy with which the experiments could be described. The calculations were performed in two-dimensional cylindrical geometry using exact perturbation theory and cross sections generated by the cell-program ZERA. Heterogeneity effects of the order of 20% were found for the largest void constructed. More significant is that the maximum void effect occurs at a smaller radius for the heterogeneous case than for the homogeneous one. The difference between the calculated maximum void for the homogeneous case and the heterogeneous case will then be even larger. Experiments were also conducted to study the effects of anisotropic diffusion caused by the heterogeneous structure of the plates. The experiments were analyzed with the cell program KAPER which was extended to calculate the components of the diffusion coefficient parallel and perpendicular to the plates through application of theory of Benoist. The satisfactory agreement with the experimental results assured a qualitative understanding of the diffusion effect. (auth)

7597 ANALYSIS OF DOPPLER EXPERIMENTS. Matsuno, Y.; Yoshida, T.; Iijima, S.; Kamei, T. (Nippon Atomic Industry Group Co. Ltd., Kawasaki). pp 984-1004 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

In the nuclear design of JOYO reactor, the design value of Doppler reactivity was determined by applying the bias factor (E/C) to the calculated value. The bias factor, 0.93 ± 0.20, had been determined from the analysis of the sample Doppler experiments performed on JOYO mockup assemblies at FCA. The results of analysis of Doppler experiments on SEFOR Core-I, SEFOR mockup and JOYO mockup are described and applied to re-evaluate the JOYO value of Doppler reactivity. The calculations are based on the two dimensional diffusion approximation and first-order perturbation theory. The cross section set used was the NAIG Nuclear Set No. 5 (NNS-5) which had been used for JOYO design work. The Doppler effect of the structural materials, which previously had been ignored, was taken into consideration. The resultant C/E values were 1.06 ± 0.04 and 0.98 ± 0.04 for ZPR-3-47 and FCA-V-1, respectively. That of SEFOR was 1.00 ± 0.10. From the constancy and the consistency of these C/E values, the bias factor to be applied to JOYO design was re-evaluated as 1.02 ± 0.20. This value fulfills, including the value of uncertainty, the required design accuracy of JOYO. (auth)

7598 U. S. THEORETICAL AND COMPUTATIONAL PROGRAM. Stacey, W. M. Jr. (Argonne National Lab., IL); Toppel, B. J.; Hwang, R. N.; Henryson, H. II; Lathrop, K. D. pp 1153-1171 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Recent methods and code development activities which have taken place within the U. S. LMFBR physics program are briefly reviewed. The activities fall within nine general areas. (1) Resonance theory, (2) multigroup cross-section generation, (3) sensitivity methods and studies, (4) fuel cycle, (5) Monte Carlo, (6) dynamics, (7) multidimensional diffusion theory, (8) transport theory, and (9) code systems and coordination. (auth)

7599 IMPROVEMENTS OF THE PREDICTED CHARACTERISTICS FOR FAST POWER REACTORS FROM INTEGRAL EXPERIMENTS. Cadarache Version III Multigroup Cross Section Set. Chaudat, J. P.; Barre, J. Y.; Khairallah, A. (CEN de Cadarache, Saint-Paul-les-Durance, France). pp 1207-1238 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The approach used at CEA to improve the basic neutron data of a multigroup cross section set from integral experiments is described. Included are improvements of the calculational method (cell code HETAIRE) and statistical and direct adjustment of the multigroup cross section set. The performance of the CADARACHE Version III set, in operation from January 1973, and the consequences on the main parameters of a power reactor are presented. The planned future improvements of the set are analyzed. (auth)

7600 ANALYSIS OF FCA CRITICAL EXPERIMENTS AND ITS APPLICATION TO JOYO NUCLEAR DESIGN. Iijima, S. (Nippon Atomic Industry Group Co. Ltd., Kawasaki); Shimizu, A.; Inoue, T. pp 1344-1368 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

A series of extensive mockup experiments in support of Japanese Experimental Fast Reactor, JOYO, were performed at the Fast Critical Assembly FCA from February 1970 to March 1972. The results of the analysis of these mockup experiments and their application to the JOYO nuclear design are described. The basic calculational method of the analysis is the same as that employed in the JOYO neutronics calculation, viz., the 6-group diffusion theory using 25-group NAIG Nuclear Set No. 5. Corrections to the base calculations were evaluated by using one-dimensional S_4 transport theory and integral transport theory. The ABBN group constants were also used for the sake of comparison. The highlights of the analysis are as follows: (1) The C/E ratio of criticality factor was determined as 1.006 for NNS-5 and 1.037 for ABBN group contants. (2) The criticality factor of the JOYO clean core with all control rods withdrawn was predicted by two different methods; direct application of the C/E ratio and the method of material density coefficients, with both methods yielding almost identical results. (3) The C/E ratio for the worth of highly enriched B_4C rods was determined as 1.05 ± 0.08. The method of calculating the rod heterogeneity effect was verified. The positive interference effect was found for two rods separated over a certain distance. (4) The reaction rate distributions deep in the blanket were underestimated by 10 - 30%. (5) The gamma-ray dose distribution was predicted satisfactorily, provided that the source distribution was corrected by using measured reaction rate ratios and reaction rate distributions. (6) The C/E ratios for central Doppler reactivity, sodium void reactivity, material density coefficients, and material substitution worths were determined. The most probable values of JOYO neutronics parameters were determined by applying the bias factor (E/C) to the calculated values. The uncertainties of the most probable values were also determined, and they were taken into consideration in the JOYO design. (auth)

7601 REVIEW OF NEUTRONICS CONSIDERATIONS ARISING FROM STUDIES FOR A PROPOSED 1200 MW(e) FAST REACTOR. Mougniot, J. C.; Clauzon, P.; Dulieu, P.; Giacometti, C.; Neviere, G. (CEN de Cadarache, Saint-Paul-les-Durance, France). pp 1395-1407 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The specific neutronic problems encountered during the study of a 1200 MW(e) fast reactor core are discussed. The study of the equilibrium core is presented, stressing the advantage of a suitable power flattening during a core cycle. In particular, it is shown that the use of absorbing rods, allowing a good hot spot control, is at least as important as the core zoning with different enrichments. Shadow and anti-shadow effects on control rods are pointed out. The transition from the initial fresh core to the equilibrium core is analyzed by comparing available solutions (diluents, control rods, enrichment). Taking into account the increased importance of power distribution disturbances in this type of reactor, the advantages of an experimental program in order to confirm the theoretical studies are pointed out. (auth)

7602 INTERCOMPARISON OF LARGE FAST POWER REACTOR CALCULATIONS. Nakagawa, H. (Tokyo Electric Power Co. Inc.); Inagaki, T.; Yamashita, Y.; Kobayashi, T.; Nishiyama, M. pp 1408-1424 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Intercomparison of reactor core calculations has been performed by five industry groups in Japan. Six sets of group constants modified by each group, including the JAERI-Fast Set, are combined with several diffusion theory codes in calculating six test cores with 1000 or 1500 MW(e) of power and 80, 110, or 140 cm core height. As a conclusion of the study, deviations in k_{eff} of about 1.9% are obtained by means of different group constant sets and calculation codes. The uncertainty in power peaking factors is nearly 2.0%. Uncertainties in reactivity changes induced by Na voiding in the core are 10 to 30%. The Doppler effects and the central reactivity worth of a control rod have 20 to 30% uncertainties. In the large equilibrium core, reactivity worths of the higher order Pu isotopes and fission products become larger, therefore their uncertainties should be evaluated and diminished. The breeding ratio of each core is nearly 1.24, independent of reactor size used in this study. Deviations in neutron spectra and spectral indices may roughly indicate that some of the group constants such as scattering cross section of Na, capture cross section of ^{238}U, and fission cross section of ^{241}Pu, should be reevaluated. (auth)

7603 CONTRIBUTIONS OF ZPPR-3 DEMONSTRATION PLANT PREENGINEERING CRITICAL EXPERIMENTS AND SEFOR TO RESOLUTION OF LMFBR PHYSICS PROBLEMS. Greebler, P. (General Electric Co., Sunnyvale, CA); Bailey, H. S.; Stewart, S. L.; Amundson, P. I.; Carpenter, S. G. pp 1462-1476 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Accurate predictions of Doppler and sodium void reactivity and of power distributions and control rod worths for representative control insertion patterns are important in fast reactor systems design because of the impact of these parameters on safety, operational reactivity monitoring, and core performance. Experiments performed in the SEFOR reactor and in the ZPPR-3 critical

assemblies have provided an abundant source of integral data that permit a good assessment of the adequacy of current methods used in the calculation of these important physics parameters. The objective of the ZPPR-3 Demonstration Plant Benchmark Program is the study of control system effects in a 350 MW(e) LMFBR having 19 B_4C control rods with a total worth of ~40$. Major emphasis is on the perturbations of power distribution and control rod worths caused by various control rod patterns representative of those expected in the reactor over a full operating cycle. Measurements also include sodium void reactivity and small sample Doppler effect to assess the influence of the control system on these safety parameters. It was predicted by analysis and confirmed by measurements that the different control rod patterns have a strong perturbing influence on both the power distribution (15% changes for reasonable rod patterns and 30% for more extreme ones) and on individual control rod worths (changes of 20 to 30%). (auth)

7604 COMPARATIVE ANALYSIS OF ENDF-B/III AND KEDAK FOR FAST REACTOR CALCULATIONS. Yiftah, S.; Gur, Y.; Segev, M.; Gitter, L. (Soreq Nuclear Research Center, Yavne, Israel). pp 1479-1490 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The American ENDF-B/III, the German KEDAK, the British UKNDL, and the Russian evaluated nuclear data files serve today as the main sources of nuclear data for the calculation of fast reactors. Every country, naturally, uses its own evaluated file and the question that has been asked for some time is the following: are the physics parameters of the fast reactors being calculated and designed a function of the specific evaluated data file that is used in the calculations? In other words, would these physics parameters remain the same were the calculations to use as input a different evaluated data file? To try and shed some light on this problem a study has been undertaken where the comparative analysis of the evaluated files is performed on several levels; namely the basic-microscopic-data level, the multigroup-cross-section-set level, and the physics-parameters-of-specific-systems level. The dependence of k_{eff} and the sodium void coefficient of typical fast reactor systems has previously been shown to be greatly influenced by the nuclear data file chosen. Identical techniques are used to obtain selfshielded multigroup sets from ENDF-B/III and KEDAK as input to the computation of important physics parameters, using the same reactor codes. Perturbation theory has been applied to analyze differences in k_{eff} values of typical fast systems in terms of group cross sections. Because of the identical input processing methods and calculation techniques, the differences in group cross sections are attributed directly to the differences in the nuclear data input. Practical conclusions are discussed. (auth)

7605 EVALUATION OF THE EFFECT OF SOME TECHNOLOGICAL PARAMETERS ON FAST REACTOR CHARACTERISTICS. Yurova, L. I.; Shmelyov, A. N.; Murogov, V. M.; Ilunin, V. G.; Khromov, V. V. (Moscow Physical-Technical Inst.). pp 1535-1549 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The sources of uncertainty in physical parameters of nuclear power plants may be in nuclear data, material property data, in the assembly geometry of reactor cores, and in the reloaded fuel conditions in the process of operation. Therefore, it is important to have some idea of the effect of initial parameters on the operating conditions of reactors and on atomic power plants as a whole. The calculation investigation of the oxide-fueled, 1000 and 1500 MW(e) sodium-cooled nuclear power plants was made with the ROKBAR program for optimization. The optimized characteristics of the fast reactors were obtained by taking into account the interrelation of neutron field and power distribution, temperature field in fuel pins, the mechanical properties of materials, external fuel cycle time, and reactor fueling time, etc. The stabilization of power distribution in the core during its operation permits an increase in fuel specific power in the fuel cycle by 20%, a reduction in doubling time by 15-20% with breeding ratio unchanged, and an increase in average coolant heating. Subassembly geometry determines the limiting parameters which greatly influence the optimum characteristics of reactors. The use in large fast reactors of the plutonium accumulated in thermal power reactors, that is the plutonium with large content of high plutonium isotopes, leads to improvement in their characteristics and changes in core geometry. (JA)

7606 ADVANCED BREEDER FUEL DEVELOPMENT PROGRAM 1975-1985. Cunningham, G. W. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 83(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7607 CORE DESIGN AND PERFORMANCE ASPECTS OF ADVANCED FBR FUELS. Huebotter, P. R.; Akin, R. J. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 86(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7608 OPTIMUM PIN DIAMETER FOR LMFBR ADVANCED FUELS. Doherty, P. K.; Caspersson, S. A.; Hanus, N.; Noyes, R. C.; Stuteville, D. W. (Combustion Engineering, Inc., Windsor, CT). Trans. Amer. Nucl. Soc.; 19: 87-88(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

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From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

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From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7649 MEASUREMENT OF HIGH-ENERGY LMFBR NEUTRON SPECTRA. Reynolds, R. S. (Mississippi State Univ., Mississippi State); Simons, G. G. Trans. Amer. Nucl. Soc.; 19: 419-420(1974).
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7650 RESULTS OF OPTIMIZATION OF 1000 MW(e) FAST REACTORS COOLED WITH NITROGEN TETROXIDE. Krasin, A. K.; Nesterenko, V. B.; Naumov, V. A.; Bubnov, V. P.; Mirgorodskij, V. S.; Sal'nikov, L. I.; Slizov, V. P.; Stavrov, A. I. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 5-12 (1973). (In Russian).
The results of the optimized study of the nuclear power plant with fast reactors, cooled by dissociating N_2O_4, were reported. The fast reactors, designed as a single unit with electrical output of 1 million kW, were examined. A matrix fuel consisting of particles PuO_2 and UO_2 coated with Cr–Ni to prevent chemical reaction of the N_2O_4 with the dioxides was used as the fuel composition. The concentration of the metal in the matrix was assumed equal to 30% by volume. The doubling time and the fuel component of the calculated cost were used as the criteria for the selection of the optimum parameters of the reactor. (tr-auth)

7651 FORMING OF THE STRUCTURE OF VIBRATION-COMPACTED URANIUM DIOXIDE IN FUEL ELEMENTS DURING FULL-SCALE TESTS IN A FAST BOR-60 REACTOR. Davydov, E. F.; Syuzev, V. N.; Petukhov, A. A.; Antipina, M. M. Sov. At. Energy (Engl. Transl.); 36: No. 4, 382-384(Apr 1974).
Translated from At. Energ. (USSR); 36: No. 4, 306-308(Apr 1974).
An experimental assembly of fuel elements containing uranium dioxide compacted to 8.0, 8.5, and 9.0 g/cm^3 was irradiated to a 2.3% depletion of heavy atoms. No cladding failures were observed. Metallographic analysis revealed the formation of a three-zone granular structure in all irradiated elements. In addition, a uniform axial cavity was formed in the elements of 9.0 g/cm^3 density. In the lower-density elements the axial cavity was larger in the middle of the element than at the ends, an effect attributed to an axial mass transfer of fuel from the center to the ends of the active zone resulting from a vapor phase in the field of the axial temperature gradient. (DG)

7652 HEAT EXCHANGE IN THE INTERPIPE SPACE OF THE INTERMEDIATE HEAT EXCHANGER OF A BOR-60 INSTALLATION. Kondrat'ev, V. I.; Krupkin, L. K.; Masnyi, V. F. Sov. At. Energy (Engl. Transl.); 36: No. 4, 380-381(Apr 1974).
Translated from At. Energ. (USSR); 36: No. 4, 305-306(Apr 1974).
The heat transfer coefficient in an intermediate heat exchanger was investigated for a constant secondary sodium flow rate of 300 m^3/h and primary flow rates of 30 to 500 m^3/h with primary temperature drops of 100, 150, and 200°C. The measured values were significantly lower than predictions at primary flow rates lower than 300 m^3/h, but better agreement was noted for higher primary flow rates. The role of countercurrent flow in the observed behavior is mentioned. (DG)

7653 THE EVALUATION OF THE EFFECT OF SOME TECHNOLOGICAL PARAMETERS ON FAST REACTOR CHARACTERISTICS. Yurova, L. I.; Shmelyov, A. N.; Murogov, V. M.; Ilunin, V. G.; Khromov, V. V. (Moskovskij Inzhenerno-Fizicheskij Inst. (USSR)). pp 1535-1549 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo, Japan; Power Reactor and Nuclear Fuel Development Corp. (1973).
From IAEA conference on physics of fast reactors; Tokyo, Japan (16 Oct 1973).
The sources of the uncertainty in physical parameters of plants may be in nuclear data, material property data, in the assembly geometry of reactor core and in the reloaded fuel conditions in the process of operation. Therefore, it is important to have some idea on the effect of initial parameters on the operating conditions of reactors and on atomic power plants as a whole. The calculation investigation of the oxide-fueled, sodium-cooled nuclear power plants with 1000 and 1500 MW(e) was made with ROKBAR program for optimization. The optimized characteristics of the fast reactors were obtained by taking into account the interrelation of neutron field and power distribution, temperature field in fuel pins, the mechanical properties of materials, external fuel cycle time, and reloading reactor time, etc. The stabilization of power distribution in the core during its operation allows to increase fuel specific power in fuel cycle by 20%, to reduce doubling time by 15-20% with breeding ratio unchanged, and to increase average coolant heating. (JA)

Research, Test, and Experimental Reactors

Refer also to abstracts 5975, 7374, 7573, 7584, 7586–7589, 7591, 7592, 7603, 7624, 7633, 7646, 7647, 7752, 7753, 7756, 7765, 7768, 7769, 7771, 7773, 7782, 7784, 7817, 7831, 7850, 7886, 7887, and 7897.

7654 (BNWL-SA-4965) OPERATING EXPERIENCE WITH PLUTONIUM MATERIALS IN EXPERIMENTAL REACTORS. Lloyd, R. C.; Bierman, S. R.; Clayton, E. D. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jul 1974. Contract AT(45-1)-1830. 11p. (CONF-740841-1). Dep. NTIS $4.00.
From conference on research, test and training reactors; Charlottesville, Virginia, USA (12 Aug 1974).
A description of the Plutonium Solution System and the Remote Split Table Machine at the Hanford Critical Mass Laboratory is given. Criticality studies with plutonium-bearing materials are described together with contamination control measures and practices. (DG)

7655 (BNWL-tr-132) CALCULATION OF SHUTDOWN COOLING OF BOR-60 REACTOR ASSEMBLY IN A GASEOUS MEDIUM. Antipin, G. K.; Kondrat'ev, V. I.; Massny, V. F.; Timchenko, B. P. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1972. Translation of SRARI-P-176. 32p. Dep. NTIS $4.75.
A calculation of the shutdown cooling of the BOR-60 reactor assembly in a gaseous medium is presented. Shown are calculation method, programming, results of experimental studies on the model of a working assembly, a comparison between experiment and calculation results of temperature fields in the assembly with varying powers of residual energy extraction, as well as different gas flow through the assembly. (auth)

7656 (COO-3409-3) NINETEENTH ANNUAL PROGRESS REPORT OF THE PENNSYLVANIA STATE UNIVERSITY BREAZEALE NUCLEAR REACTOR, JULY 1, 1973–JUNE 30, 1974. Levine, S. H.; Robinson, G. E. (Pennsylvania State Univ., University Park (USA). Dept. of Nuclear Engineering). Jun 1974. Contract AT(11-1)-3409-3. 84p. Dep. NTIS $7.25.
The administration, facility operation, and research and educational utilization of the Penn State Breazeale Nuclear Reactor from July 1973 through June 1974 are summarized. (JWR)

7657 (EUR-4808f) EXPERIMENTAL STUDY OF THE VERTICAL DISTRIBUTION OF TEMPERATURE AND POWER

MEASURED IN THE HIGH FLUX REACTOR AT PETTEN WITH THE AID OF CONTROLLED FUEL ELEMENT NT-5. Haas, D. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). 1974. 134p. (In French). Dep. NTIS (US Sales Only) $9.75. EUR FB 175,-.

Hydraulic and thermal experiments have been made in the High Flux Reactor (HFR) at Petten (the Netherlands) with the help of a 23-plate fuel element, which was equipped with 24 thermocouples. Temperature measurements have been carried out in 3 regimes of the coolant flow: forced convection (normal operation conditions); transient flow conditions, such as a sudden failure of the coolant pumps; and steady state natural convection flow representing the conditions at the end of the pump failure flow transient (the reactor after-heat being simulated by low constant reactor power). The main results can be summed up as follows: (1) In general a good agreement between measured and calculated results was found (within 6%). It is of special interest that the vertical power distribution can be rather well approximated by a 4th order polynomial. (2) During the reactor cycle, with increasing control rod insertion, the power distribution has the tendency to assume a flatter and more symmetrical shape. (3) The maximum wall temperatures determined for the first transient measurement (with flow inversion) are of the order of 110°C, which could correspond to temperatures of about 150°C at the end of a reactor cycle. (4) The second transient measurement (at the end of a reactor cycle) showed that an emergency pump having a capacity of 300 m^3/hour is sufficient to satisfy the emergency cooling requirements of the reactor. (auth)

7658 (HEDL-SA-691) ENGINEERING SCALE TESTS OF AN FFTF FISSION GAS DELAY BED. Kabele, T. J.; Bohringer, A. P. (Westinghouse Hanford Co., Richland, Wash. (USA)). [nd]. Contract AT(45-1)-2170. 12p. (CONF-740807-20). Dep. NTIS $4.00.

From 13th air cleaning conference; San Francisco, California, USA (12 Aug 1974).

The dynamic adsorption coefficient of ^{85}Kr on activated charcoal from a nitrogen carrier gas was measured at −80 and −120°C at pressures of zero and 30 psig. The effects of the presence of impurities in the nitrogen carrier gas (1% oxygen, and 100 vppm carbon dioxide) on the adsorption coefficient of ^{85}Kr were also measured. The ^{85}Kr adsorption coefficient increased with decreasing temperature, and increased with increasing pressure. The presence of oxygen and carbon dioxide impurities in the nitrogen carrier gas had no discernible effect upon the adsorption coefficient. The adsorption coefficient for ^{85}Kr from nitrogen gas was lower than for adsorption of ^{85}Kr from an argon gas stream. The work concluded a test program which provided design data for the fission gas delay beds which will be installed in the Fast Flux Test Facility (FFTF). (auth)

7659 (HEDL-TME-74-15) PECT-2T PRETEST ANALYSIS OF THE HUT-CAL-2 TRANSIENT TEST. Gneiting, B. C.; Bard, F. E. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Apr 1974. Contract AT(45-1)-2170. 52p. AT.

The pretest thermal/deformation analyses used to obtain test requirements for the HUT-CAL-2 transient test are described. The PECT-2T thermal/mechanical performance code was used to obtain the recommended TREAT transient by systematically adjusting both the reactor power and the capsule preheat temperature until a maximum cladding effective nonelastic strain of 1.9% and a maximum fuel areal melt of approximately 54% was calculated. The material presented in this report as well as post-test measurements on this well characterized, variably dimensioned fuel pin will be used to verify and calibrate the existing material model in PECT-2T. The current PECT-2T gap conductance model, the L-2-3 fuel pin (hottest fresh pin in H3 transient test) parametric study, and the PNL-59-16 fuel pin correlation using PECT-2T are also presented. (auth)

7660 (HEDL-TME-74-26) TEST REPORT: SODIUM LEAK DETECTOR INSERTION AND EXTRACTION TESTING. Gilmore, R. F. (Hanford Engineering Development Lab., Richland, Wash. (USA)). May 1974. Contract AT(45-1)-2170. 33p. AT.

Thermocouple wires with leak detector tips were inserted and withdrawn from curved guide tubes under simulated in-reactor temperature conditions at 500°F after several hours dwell at 1000°F. The guide tube bends were representative of reactor designs except that they were fore-shortened in length. Testing verified that the leak detector insertion and removal concept for the FFTF is feasible when a specific antiseize lubricant is used. Additional evaluations are required to qualify a lubricating material for reactor applications or to demonstrate withdrawals after high temperature dwell without the use of a lubricating material. (auth)

7661 (JAPFNR-167) APPLICABILITY OF TWO-DIMENSIONAL SHIELDING CODE. Tanaka, Y.; Suzuki, I.; Takemura, M.; Suzuki, T. (Kawasaki Heavy Industries Ltd., Kobe (Japan)). Aug 1974. 59p. Dep. NTIS (US Sales Only) $5.45.

For Power Reactor and Nuclear Fuel Development Corp., Tokyo, Japan.

Two-dimensional shielding code RASC-2D has been improved to treat line-of-sight calculations in an annular duct with axial symmetrical geometry. As an application of the improved RASC-2D code, the analysis of the main shield of the Prototype Fast Reactor "MONJU" has been performed and the effects of neutron streaming along voids and the shielding effects of top shield and the adjacent concrete shield are shown and compared with previous results. It is clear that albedo effects at void surfaces are small in the high energy region and large in the low energy region. (auth)

7662 (JINR-P13-8045) VARIABLE MECHANICAL STRESSES CAUSED IN THE FUEL CANS OF THE IBR-30 REACTOR BY POWER SURGES. Dmitriev, V. S.; Il'inskaya, L. S.; Pogodaev, G. N.; Podnebesnov, V. V.; Rogov, A. D.; Rudenko, V. T.; Shatskaya, O. A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1974. 18p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

A method is described for the measurement of variable mechanical stresses excited by power surges in the fuel cans of the IBR-30 reactor and the results are reported. At energies of power surges of 2×10^{15} fissions (average heating of the fuel is about 20°C per surge) the maximum stresses in the cans, caused by longitudinal and transverse oscillations, are 7×10^5 and 5×10^5 n/m^2 respectively. (tr-auth)

7663 (JPRS-63420, pp 3-13) NUCLEAR RESEARCH AT THE NUCLEAR REACTOR OF BUDAPEST TECHNICAL UNIVERSITY. Csom, G.; Zsolnay, E. (Budapest Technical Univ.). 12 Nov 1974. Translated from Energ. Atomtech.; No. 8, 362-365 (1974).

The research projects and educational activities at the Budapest Training Reactor are briefly summarized. (JWR)

7664 (JUL-1066-RG) CONTRIBUTION TO THE PROBLEM OF REACTIVITY-DETERMINATION IN REACTORS WITH LOW ABSORPTION REFLECTORS WITH THE AID OF PULSED NEUTRON MEASUREMENT. Hecker, R.; Ahmad, S. K.; Kirch, N.; Paul, N. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorentwicklung). Jun 1974. 32p. (In German). Dep. NTIS (US Sales Only) $4.75.

Pulsed measurements at a heavily reflected critical facility, the Incore Thermionic Facility (ITR), are described. Special features of this facility are the use of zirconium hydride as a moderator and beryllium as reflector material. Subcriticality is achieved either by removing fuel elements from the core and their substitution by Al dummies (reflector unchanged) or by moving parts of the reflector (core unchanged). The latter approach results in rather unsymmetrical configurations combined with the excitation of higher modes. The reactivity determination in such cases is apparently influenced by kinetic distortion. It is shown that the application of the Sjöstrand-area ratio method gives better results than calculations and/or measurements performed with the method of inverse kinetics. It is also shown, especially for unsymmetric cases, that counters capable of suppressing the thermal neutron energy region give better agreement with the results of other methods. (auth)

7665 (KFKI-74-67) SEVEN-YEAR TEST OF OPERATING THE RECONSTRUCTED BUDAPEST REACTOR WWR-C. Varkonyi, L.; Franki, L.; Goda, L.; Vizdosh, G.; Tot, M.; Balog, Sh. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). 1974. 48p. (In Russian). Dep. NTIS (US Sales Only) $5.50.

After a brief description of the reactor reconstruction, a discussion of the experience gained during the subsequent seven years in operation, core assemblies, fuel element economies, dosimetry, control, engineering and heavy-current problems is presented. The fields of application of the reactor are also discussed. (auth)

7666 (ORNL-4979, pp 247-251) HPRR AND ACCELERATOR OPERATIONS. Ward, D. R.; Haywood, F. F.; Dickson, H. W.; Fox, W. F.; Littleton, C. P.; Wagner, E. B.; Judish, J. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The operations of the HPPR and the Dosar Low Energy Accelerator are summarized. Research and educational uses of the facilities are mentioned. (JWR)

7667 (ORO-4014-5) ANNUAL PROGRESS REPORT OF THE UNIVERSITY OF FLORIDA TRAINING REACTOR, SEPTEMBER 1, 1973–AUGUST 31, 1974. Diaz, N. J. (Florida

Univ., Gainesville (USA). Dept. of Nuclear Engineering Sciences). 1974. 44p. Dep. NTIS $5.25.

The facility operation, modifications and maintenance, radioactivity releases and environmental surveillance, and facility utilization of the University of Florida Training Reactor during the period September 1, 1973 through August 31, 1974 are reported. (JWR)

7668 (PTB-FMRB-56) FLUX DENSITY PROFILE OF THERMAL NEUTRONS IN THE CORE OF THE BRAUNSCHWEIG RESEARCH AND MEASURING REACTOR. Knauf, K.; Wittstock, J. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany)). Sep 1974. 86p. (In German). Dep. NTIS (US Sales Only) $7.50.

At the Braunschweig Research and Measuring Reactor (FMRB) the thermal neutron flux density distribution in a vertical section in the core is measured by activating wires of a Dy-Al-alloy. The result is represented by contour lines. The method of measuring is described and thermal neutron flux density profiles over a variety of sections in the core, e.g., over a section in a control rod element at 5 rod positions is presented. (auth)

7669 (RCN-216) CHARACTERISTICS OF H. F. R. FACILITIES. 1974 Edition. van der Werve, H.; Zijp, W. L. (Stichting Reactor Centrum Nederland, Petten). Sep 1974. 34p. Dep. NTIS (US Sales Only) $4.75.

A compilation of thermal and fast neutron flux density values is presented for the 45 MW core configuration with fuel assemblies containing boron as burnable poison. No data are available for the beam tube arrangements. The values presented should be handled with some caution. They represent best estimates for nominal values, and can deviate from the actual neutron flux density values, which are dependent upon distribution of the boron- and fuel charge over the cores, the number and type of irradiation experiments installed and the position of the control members. Some results of spectrum evaluations according to the SAND-II method are also presented. Furthermore data on the damage-to-activation ratio for graphite irradiations in experiment positions are given. (auth)

7670 (TID-26667) ANNUAL REPORT, JANUARY 1–DECEMBER 31, 1973. (Texas Univ., Austin (USA). Nuclear Reactor Lab.). Mar 1974. Contract AT(40-1)-3919. 48p. Dep. NTIS $5.50.

A heat exchanger was installed which increased reactor utilization by making the reactor available on a five day basis at the maximum power of 250 kW. The reactor core was converted to an all Mark III stainless steel clad fuel, thus enabling the NRL staff to request a power increase to 500 kW and $3.00 reactivity pulsing in 1974. An enclosure was constructed around the reactor console to provide the isolation and restriction advantages of an enclosed control room for reactor operation. Research projects conducted at the NRL are listed. (auth)

7671 (WARD-NA-3045-13) FRICTION AND WEAR TESTING IN SUPPORT OF FFTF COMPONENTS. Interim Summary Report, August 1974. Wilson, W. L.; Minushkin, B.; Chelen, G. (Westinghouse Electric Corp., Madison, Pa. (USA). Advanced Reactors Div.). Nov 1974. Contract AT(11-1)-3045. 132p. AT.

Friction and wear testing to support design of components for sodium cooled reactors requires specialized facilities capable of simulating the environmental and operating conditions anticipated throughout the reactor system. Investigations of parametric variables such as coolant temperature, velocity and impurity levels, sliding distance and velocity, contact pressure, and relative geometric factors must be possible. Friction and wear tests in flowing sodium were conducted at Westinghouse Advanced Reactors Division (ARD) in support of specific Fast Flux Test Facility (FFTF) In-Vessel Handling Machine (IVHM) and core components interfaces in three sodium friction and wear test facilities. Test results for Inconel 718 rubbing against itself in 450°F sodium indicated the following: (1) Lubricative surface films have a significant effect on friction behavior, (2) Friction coefficients decrease slightly with increasing contact pressure in the 500 to 5000 psi range, (3) Short stroke amplitudes result in higher friction coefficients than longer strokes, and (4) Sodium oxygen contents of up to three ppm have no significant effect on friction coefficients. At oxygen levels of eight to ten ppm, however, friction coefficients decrease by a factor of approximately ten percent. Tests were also performed to investigate the friction and wear behavior of several candidate carbide coatings for use on Fast Test Reactor (FTR) fuel assembly duct load pads and other critical in-core component interfaces. A chromium carbide-nichrome binder powder mixture, applied by a commercial detonation-gun process, has been selected as the reference material for the FFTF duct load pad application. The experimental facilities and techniques developed to obtain friction and wear data in high temperature sodium and gas environments are discussed. Detailed test results in support of specific FFTF-IVHM and core component interfaces are presented. (auth)

7672 REVIEW OF ZEBRA TECHNIQUES FOR THE MEASUREMENT OF REACTIVITY PARAMETERS, REACTION RATE RATIOS, AND SPECTRA. Sanders, J. E.; Burbidge, B. H.; Carter, M. D.; Hardiman, J. P.; Ingram, G. (Atomic Energy Establishment, Winfrith, Eng.). pp 908-929 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Techniques devised for measurement of reactivity parameters, within-cell reaction rates, and neutron energy spectra in plutonium fuelled assemblies in ZEBRA are described. Results of such measurements have played a major role in the adjustment studies leading to the new FGL5 Library. Emphasis is placed on the assessment of experimental and analytical errors, which are compared with target errors set by reactor physics considerations. Values for k-effective are found from careful analysis of critical mass with due account of composition and dimensional uncertainties, and k-infinity is obtained from cell worth measurements in small driven test-regions. Buckling values are derived from analysis of fission scan data by the experimental adjoint method using diffusion and transport theory. Foil activation, fission chamber, and solid state track recorder techniques have been applied to fission rate measurements with ^{239}Pu, ^{235}U, and ^{238}U. Capture rates in ^{238}U are obtained from thermal comparison and absolute counting methods. Spectrum measurements have been made by a range of techniques covering a total energy range from 100 eV to 6 MeV. These include time-of-flight, proton recoil, lithium-6 and double scintillator spectrometers. Comparison of different techniques over their range of overlap provides a check on the internal error estimation. Only the time-of-flight method is applicable below 5 keV, and improvements to various aspects of this technique are still needed to obtain the desired confidence in the Doppler region. Data from the spectrum measurements have been input to the LSQ adjustment scheme leading to the production of the FGL5 Data Library, the information being presented in the form of ratios of flux in adjacent groups of a 10 group set. Spectrum predictions before and after the adjustment process are compared. (auth)

7673 PHYSICS EXPERIMENTS WITH YAYOI. An, S.; Tamura, T.; Furuhashi, A.; Wakabayashi, H. (Tokyo Univ.). pp 152-174 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

YAYOI is a fast neutron source reactor operated by the University of Tokyo in Tokai-mura since April 1971. The reactor is a 2kW air cooled fast reactor fueled with 28 kilograms of 93% enriched metallic uranium which is to be considered as a development of AFRS and HARMONIE. It was installed for the purposes of extensive research work in the fast neutron field and for education and training. The unique feature of YAYOI is the horizontal movability of the core assembly through a steel frame 13 meters in length. The core can be stopped and operated at six positions, among which three are located in a large lead intermediate column. The reactor has been stably operated with little difficulty experienced. Operating experience and measured reactor characteristics are presented. Physics experiments include neutron dose and spectrum measurement in experimental holes and columns, kinetic parameters such as β/l, and temperature feed back coefficients. Reactivity worths of several materials and the kinetic behavior of the reactor operated in combination with the five kinds of pile oscillators were also measured. Several experiments using YAYOI as a fast neutron source have been performed. Included are buckling and spectrum measurements in a natural uranium assembly, transmission of fast neutrons through material layers, and irradiation of semiconductors and high-polymers. A liquid helium cryogenic system for low temperature irradiation is in preparation. YAYOI is intended to be operated as a dynamic (fast pulsed) reactor in the future. Pile oscillator systems will serve for this purpose together with a planned electron Linac as a synchronized neutron source. The power shape and behavior of the reactor are estimated by the dynamics calculation code AIREK-PUL-YAYOI (a modification of AIREK) and CONEC-YAYOI (a modification of CONEC). A time-of-flight measurement system with a 100m flight path and a facility for fission neutron pulse radiolysis are also projected as advanced research tools. A reactor of YAYOI type may be recommended as a research and training reactor for university use because of its research versatility and operational reliability. (auth)

7674 STUDIES OF UNIT K-INFINITY LATTICES IN METALLIC URANIUM ASSEMBLIES ZEBRA 8H, SNEAK 8, ERMINE AND HARMONIE UK. Darrouzet, M. (CEN de Fontenay-aux-Roses, France); Chaudat, J. P.; Fischer, E. A.; Ingram, G.; Sanders, J. E. pp 537-570 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Experimental lattices consisting of metallic uranium with minimum diluents and with enrichments such that k_∞ (production/absorption) is close to unity have been studied in Winfrith, Karlsruhe, Fontenay aux Roses and Cadarache. After analysis of the methods developed for the derivation of k_∞ from measurements of cell reactivity worth or buckling, the experimental results are compared with the values calculated by the standard method of each laboratory. All experimental results are combined to determine the values of the enrichment and reaction rate ratios of a homogeneous uranium medium of exactly unit k_∞, the SCHERZO 556 core, which is proposed as an international standard for nuclear data tests. (auth)

7675 ANALYSIS AND CORRELATION OF MEASUREMENTS ON SNEAK AND ZPR VI FAST ASSEMBLIES BY THE ENDR/B VERSION 3 CROSS-SECTION DATA FILE. Gandini, A.; Petilli, M.; Salvatores, M. (CNEN, Casaccia, Italy). pp 629-644 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Estimates of group cross sections are obtained by adopting a correlation method based on statistical theory. The numerical calculations have been performed by the AMARA and MARA correlation codes, the first one making use of the Lagrange multipliers technique for consistently reducing the computer running time, the second one adopting the method of reduction by elements when systematic errors within the cross sections are allowed for. The starting data are represented by integral experiments obtained on the SNEAK (assemblies 7A and 7B) and ZPR VI (assembly 7) Pu-fueled fast critical facilities and by the ENDF/B (version 3) cross section data files. The integral experiments considered are the following: K_{eff}, U-238 capture and fission and U-235 fission to Pu-239 fission rate ratios. The main differential parameters involved, as resulting from a sensitivity study, were: U-238 fission, capture, and inelastic cross-sections; U-235 and Pu-239 fission cross sections; and prompt fission spectrum. The resulting optimized cross section set should be applicable to a large range of fast reactors, since the experiments involved in the correlation procedure were representative of large diluted cores (ZPR VI assembly 7) and medium size cores (SNEAK assemblies). An unfavourable χ^2 test seems to indicate the probable presence of inaccurate assessments of the initial error estimates. A few calculational checks have indicated, however, that this fact should not reduce the significance of the trends associated with the results. (auth)

7676 INVESTIGATION OF NEUTRON SPECTRA IN FAST CRITICAL ASSEMBLIES. Kazanskii, Yu. A.; Belov, S. P.; Gurin, V. N.; Dmitrieva, V. S.; Doolin, V. A. (State Committee for Utilization of Atomic Energy, Obninsk, USSR). pp 930-944 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The demands of accuracy in experimental determination of neutron spectra in fast critical assemblies are considered. On the basis of calculated coefficients of sensitivity of neutron spectra to a variation of group nuclear data, the role of measured neutron spectra in the problem of calculated data accuracy improvement is evaluated. The neutron spectrum measurement procedures used on the BFS-1 critical assembly, methods of experimental data treatment, and introduction of basic corrections are briefly described, and analysis of errors in the experimental data is carried out. The experimental data obtained for 3 fast critical assemblies are compared with the results of 26- and 250-group calculations. The most probable causes of the systematical difference between experimental results and calculations in the energy range below several keV are considered. It is shown that the use of experimental spectra when calculating central functionals improves their agreement with the experimental data. (auth)

7677 SUBCRITICALITY DETERMINATION IN THE FTR CRITICAL EXPERIMENTS PROGRAM BY A NOVEL INVERSE KINETICS METHOD AND BY THE POLARITY COHERENCE METHOD. Albrecht, R. W.; Yang, C. Y. (Washington Univ., Seattle). pp 1058-1074 of Proceedings of the International Symposium on physics of fast reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

More than 250 rod drop experiments conducted in the ZPR-9 reactor during the engineering mockup critical experiments program for the Fast Test Reactor (FTR-EMC) have been analyzed using a new inverse kinetics algorithm. Polarity coherence measurements for 200 of these cases were also conducted. The results have been compared to the results obtained by Argonne National Laboratory (ANL) using a new inverse kinetics algorithm which has been shown, through tests with simulated data, to be unbiased and to be more precise than the ANL algorithm. Using actual experimental data from the FTR-EMC, the subcriticalities determined by ANL's algorithm are found to average 0.67% larger than those calculated from the same data using the new algorithm and 1.36% larger than those measured by the polarity coherence method. Furthermore, the relative standard deviation of the ANL reactivity calculations was found to be 13% greater than the relative standard deviation of the new algorithm. As a measure of consistency, the relative discrepancy between the reactivities as estimated from the signals from two detectors were compared. It was found that the discrepancy between detectors averaged 17% greater for the ANL algorithm compared to the new algorithm. Representative subcritical reactivities, the new algorithm, and polarity coherence measurement results are presented. In the majority of the cases the ANL results indicate a larger subcriticality than the comparable values by the other methods. The discrepancy between the ANL algorithm and the new inverse kinetics algorithm generally increases with increasing subcriticality. On the basis of improved precision and decreased discrepancy between inverse kinetics and polarity coherence results, it is concluded that the new algorithm is a superior method for reactivity determination. (auth)

7678 NUCLEAR DESIGN ASPECTS OF THE FAST TEST REACTOR. Little, W. W. (Westinghouse Hanford Co., Richland, WA); Ramchandran, S. pp 1321-1343 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The nuclear design analysis associated with the Fast Test Reactor (FTR) is described. The FTR is the primary component of the Fast Flux Test Facility (FFTF), currently under construction at Hanford, and scheduled for completion in 1975. The principal nuclear design parameters are given. The objective of the FTR is to provide appreciable test volume in a high flux, instrumented environment; an objective markedly different from that of a power producing LMFBR. For this reason the nuclear design analysis posed several unique problems peculiar to the FTR in addition to many of the problems traditionally encountered in LMFBR design. Perhaps the two most significant design aspects which caused novel problems in analysis were the large heterogeneities of the test loops and the nickel-iron reflector, which was used in place of a uranium blanket to enhance the neutron flux level. The FTR physics problems discussed can be classified into three general areas: (1) statics, including specification of initial loadings, power profiles, and the total power capability, (2) long term reactivity variations, which includes assessment of fuel management and control rod worth, and (3) safety parameters, which consist primarily of the Doppler, sodium, and expansion coefficients. The analytic methods employed are discussed in detail. Particular emphasis is placed on the extensive three-dimensional modelling employed for both fuel management planning and the analysis of critical assemblies. (auth)

7679 PERFORMANCE PREDICTIONS OF FTR FUEL. Baker, R. B. (Westinghouse Electric Corp.; Richland, WA); Leggett, R. D.; Cole, C. R. Trans. Amer. Nucl. Soc.; 19: 117-118(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7680 POWER BURST FACILITY FUEL STUDIES. Cole, J. T. (Aerojet Nuclear Co., Idaho Falls, ID); Wood, R. E. Trans. Amer. Nucl. Soc.; 19: 127(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7681 TREAT CONVERTER FUEL STUDIES. Schumar, J. R.; Brittan, R. O. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 127(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7682 HIGH-TEMPERATURE FUEL FOR TREAT CONVERTER STUDIES. Davidson, K. V. (Los Alamos Scientific Lab., NM). Trans. Amer. Nucl. Soc.; 19: 128(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7683 FUEL ELEMENTS FOR PULSED TRIGA RESEARCH REACTORS. Simnad, M. (General Atomic Inc., San Diego, CA). Trans. Amer. Nucl. Soc.; 19: 128-129(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7684 FUEL SELECTION CONSIDERATIONS FOR THE ANNULAR-CORE PULSED REACTOR PERFORMANCE IMPROVEMENT. Sasmor, D. J.; Reuscher, J. A.; Pickard, P. S.; Rivard, J. B.; Philbin, J. S.; Coats, R. L. Trans. Amer. Nucl. Soc.; 19: 129-130(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7685 MATERIAL PROPERTY DETERMINATION FOR FAST-PULSED-REACTOR FUELS BY RAPID FISSION HEATING. Reuscher, J. A.; Schmidt, T. R. (Sandia Labs., Albuquerque, NM). Trans. Amer. Nucl. Soc.; 19: 130(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7686 DESIGN OF FUEL ELEMENTS FOR A HIGH-YIELD BURST REACTOR CORE. McTaggart, N. H.; McCormick, W. B.; Cann, E. R. (Atomic Weapons Research Establishment, Aldermaton, Eng.). Trans. Amer. Nucl. Soc.; 19: 132(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7687 R-SERIES IN TREAT TEST APPARATUS. Holtz, R. E. (Argonne National Lab., IL); Grolmes, M. A.; Spencer, B. W.; Miller, C. E. Trans. Amer. Nucl. Soc.; 19: 238(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7688 ANALYSIS OF MIXED-OXIDE FUEL-ROD FAILURES IN GE EXPERIMENTS IN EBR-II. Patel, M. R.; Murata, R. E. (General Electric Co., Sunnyvale, CA). Trans. Amer. Nucl. Soc.; 19: 308-309(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7689 HANDLING SYSTEM FOR REACTOR EXPERIMENTAL LOOPS. Ahmed, H. U.; Kaspic, W. A. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 309-310(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7690 DIGITAL SIMULATION OF THE LOFT REACTOR COOLANT PUMPING SYSTEM. Feeley, J. J. (Aerojet Nuclear Co., Idaho Falls, ID). Trans. Amer. Nucl. Soc.; 19: 337-338 (1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7691 MULTIPLICATION MEASUREMENTS FOR INITIAL STARTUP WITH THE MOCKUP CORE FOR THE FFTF. Mihalczo, J. T.; Mathis, M. V. (Oak Ridge National Lab., TN). Trans. Amer. Nucl. Soc.; 19: 368-369(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7692 EVALUATION OF RECENT FISSION RATIO MEASUREMENTS IN ZPR-LMFBR CRITICAL ASSEMBLIES. McKnight, R. D.; Armani, R. J.; Bohn, E. M.; LeSage, L. G.; Wade, D. C. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 401-402(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7693 EFFECTS OF EBR-II LOADINGS ON THE COMPARISON OF MEASURED WITH PREDICTED K_{eff} VALUES SINCE THE INSTALLATION OF A RADIAL STAINLESS-STEEL REFLECTOR. Laskiewicz, R. A. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 402-403(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7694 EFFECTS OF DRIVER-FUEL LOADING AND HIGH-WORTH CONTROL RODS ON THE AXIAL FISSION RATE DISTRIBUTIONS IN EXPERIMENTAL SUBASSEMBLIES IN EBR-II. Franklin, F. C.; Meneghetti, D. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 403-404(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7695 EXPERIMENTAL STUDIES OF THE USE OF LIGHT-WATER REACTOR-GRADE PLUTONIUM IN THE FTR. Bhattacharyya, S. K.; Pond, R. B.; Bohn, E. M.; Beitel, J. C. (Argonne National Lab., IL). Trans. Amer. Nucl. Soc.; 19: 404-405(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7696 DESIGN OF A ZERO-POWER REACTOR FOR HTGR STUDIES. de A. Ferreira, A. C.; Hukai, R. Y. (Instituto de Energia Atomica, Sao Paulo, Brazil). Trans. Amer. Nucl. Soc.; 19: 405(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7697 PULSED SUBCRITICAL TWO-REGION EXPERIMENTS IN HEAVY-WATER LATTICES. Andrews, D. G. (Univ. of Toronto); Simpson, G. L. Trans. Amer. Nucl. Soc.; 19: 421-422(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7698 MEASUREMENT OF DIRECTIONAL NEUTRON FLUX IN SUBCRITICAL HEAVY-WATER LATTICE. Andrews, D. G. (Univ. of Toronto); Simard, Y. N. Trans. Amer. Nucl. Soc.; 19: 422-423(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7699 INCREASING THE NEUTRON-TO-GAMMA RATIO AT A FAST PULSE REACTOR. Dunn, T. A.; Kazi, A. H. (Ballistic Research Labs., Aberdeen Proving Ground, MD). Trans. Amer. Nucl. Soc.; 19: 477-478(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7700 ON USING THE EQUIPMENT TRANSMITTING THE INFORMATION TO THE "MINSK-22" COMPUTER FOR REACTOR EXPERIMENTS. Tyrkich, Eh. A.; Sapozhnikov, V. V.; Lukhanin, A. P.; Okhapkin, V. P.; Krylov, E. V. (AN Belorusskoj SSR, Minsk. Inst. Yadernoj Ehnergetiki). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 4, 17-19(1972). (In Russian).
A description is given of the apparatus for the recording, data extraction, and data transmission to the Minsk-22 computer. The code implementing the transmission of data to the computer is described. The operating instructions to the Minsk-22 using devices for data transmission are given. Two examples of experiments carried out on the critical assembly using these devices are described. (tr-auth)

7701 SYSTEM SAFETY DESIGN OF MULTIPURPOSE HIGH TEMPERATURE EXPERIMENTAL REACTOR. Yamada, Masao; Shimazu, Akira; Morimoto, Toshio (Fuji Electric Co. Ltd., Tokyo (Japan)). Fuji Jiho; 47: No. 4, 351-360(Apr 1974). (In Japanese).
Based on the second preliminary design of a multipurpose high temperature experimental reactor, its safety design has been studied in order to obtain fundamental information. The MHTER of heat output 50 MW is helium-cooled and graphite moderator type. The coolant gas with 1,000°C temperature at reactor outlet is used for the generation of reducing gas in iron making and for driving a gas turbine. The aspects of study on system safety design are as follows: assumption of possible accidents and their analysis; plant dynamic analysis on dualpurpose components; evaluation of radioactivity released both in normal operation and at major plant accidents; establishment of safety design standard; and engineering safety equipments for plants. (JA)

Production and Materials Testing and Processing Reactors

Refer also to abstracts 7521 and 7701.

7702 (CEA-CONF-2652) BURST CAN DETECTION FOR FUEL ELEMENTS COOLED BY HEAVY OR LIGHT WATER. Graftieaux, J.; Donguy, R.; Douet, P.; Le Meur, R.; Rouvier, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France)). 7 May 1974. 7p. (In French). (SES/PUB/AI-74-97; CONF-740537-3). Dep. NTIS (US Sales Only) $4.00.

From meeting on in-core instrumentation and failed-fuel detection and location; Toronto, Canada (13 May 1974).

Fission product detection devices for the High Flux Reactor (R.H.F.) in Grenoble (heavy water reactor) and for the IRENE fuel test loop in OSIRIS (pressurized light water loop) are described. Results are given on a fission products study on the GERMAINE loop in OSIRIS (air loop). The R.H.F. burst can detection includes two devices measuring delayed neutrons (D.N.D.). One is used to detect fuel melting, the other to observe can defects. A third device measures ionized fission product activity in the nitrogen blanket. Its purpose is to detect small can cracks. The IRENE loop burst can detection includes a D.N.D. and a scintillation counter, measuring water gamma activity. Some complementary measurements are made by germanium-lithium detectors. The GERMAINE loop is used for spectrometer calibration and for study of gaseous fission product transport, but this study has also shown transport of solid fission products without gaseous precursors. The spectra from the two loops are processed on a MULTI-8 computer, which allows peak characteristics to be determined (energy, full width at half maximum, area). This computer is also used to control the spectrometer. Thus gamma spectrometry is very useful and complementary for fission product detection. (auth)

7703 (ORNL-TM-4755) HIGH FLUX ISOTOPE REACTOR QUARTERLY REPORT, APRIL–JUNE 1974. McCord, R. V.; Corbett, B. L. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 22p. Dep. NTIS $4.25.

Operation, maintenance, and design changes of the HFIR during the quarter are summarized. Uses of the experimental facilities during the period are also reported. (JWR)

7704 (UNI-114) DETERMINATION OF HYDROCARBON DEPOSITS ON N REACTOR CHARCOAL FILTERS. Martin, E. C. (United Nuclear Industries, Inc., Richland, Wash. (USA)). [nd]. Contract AT(45-1)-1857. 5p. Dep. NTIS $4.00.

Charcoal samples were extracted with CCl_4. The resultant solutions were adjusted to known volumes. Aliquots were examined by infrared spectroscopy. The resultant spectra were compared with a calibration curve in which optical absorption was plotted against concentration of hydrocarbon. (auth)

7705 DESALINATION–NEW WATER FOR OLD. Pugh, O. (UKAEA London Office). Meerestechnik; 5: No. 4, 119-123(Aug 1974). (In German).

7 figs.

So far the role of desalination has been that of providing an essential commodity for man's survival. It is now apparent, however, that the newer desalting processes will be increasingly important in neutralizing the damaging effects of man's waste products on the environment. Desalination technology, dominated to date by distillation, contributes to only one aspect of the complete watercycle but the advent of the reverse-osmosis system introduces the technology to a further area–protection of clean-water resources from discharge of polluting waste and indeed the renovation of that waste water. (auth)

7706 ELECTRON DISTRIBUTION FUNCTIONS IN URANIUM PLASMAS. Bathke, C. G.; Miley, G. H. (Univ. of Illinois, Urbana). Trans. Amer. Nucl. Soc.; 19: 64(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7707 UTILIZATION OF OIL SHALE AND NUCLEAR PROCESS HEAT FOR STEEL MAKING. Scarpinella, C. A.; Hukai, R.Y. (Instituto de Energia Atomica, Sao Paulo, Brazil). Trans. Amer. Nucl. Soc.; 19: 353(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Propulsion and Package Reactors

7708 (BMFT-FB-K-74-01) FINAL REPORTS ON AN IN-CORE THERMIONIC REACTOR (ITR). P. 1-3. Development Work and Design of a Test Facility for an Incore Thermionic Reactor. (Bundesministerium fuer Forschung und Technologie, Bonn (F. R. Germany); Zentralstelle fuer Atomkernenergie-Dokumentation, Leopoldshafen (F. R. Germany)). Apr 1974. vp. (In German). INIS.

P. 1: 663 p.; 565 refs.; P. 2: 466 p.; 102 tabs.; 380 figs.; P. 3: 30 p. With abstract in German and English.

In January 1969, a cooperation agreement was signed by Kernforschungsanlage Juelich GmbH (KFA) and the Consortium Brown Boveri, Interatom, Siemens for development, design and construction of incore thermionic reactors. The results of the development phase carried out from August 1969 until December 1972 are summarized in the fields of core layout, full scale zero power experiment, converter physics and technology, technology of metal hydride and driver fuel elements, sodium technology, metallurgy, inpile tests with driver and converter cells, and also in the field of planning and design of a reactor test facility including the incore thermionic reactor for 20 kW electrical power output. (auth)

7709 (CNLM-5325(Vol. 1)) PROPOSAL, SECOND GENERATION PORTABLE NUCLEAR POWERPLANT. Volume I. Letter of Transmittal and Contractual Items. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.; Stone and Webster Engineering Corp., New York (USA)). 15 Nov 1963. 20p. Dep. NTIS $4.00.

Declassified 5 Nov 1971.

The formal proposal, work statement, contractual data, and an outline of costs and schedules for the development of a second generation portable nuclear power plant are presented. (JWR)

7710 (GKSS-74/E/29) NS OTTO HAHN: TEST REPORT NO. 23 FOR THE PERIOD AUGUST 28, 1973–APRIL 8, 1974. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 48p. (In German). Dep. NTIS (US Sales Only) $5.00.

Data on the performance of the NS OTTO HAHN and the OTTO HAHN reactor during voyages within the reporting period are presented. Ship and reactor maintenance, testing, and repair activities are described. Reactor research and personnel training activities conducted in cooperation with educational institutions are also discussed. (DG)

7711 (GKSS-74/E/30) EXPERIMENTAL ANALYSIS OF THE DYNAMICS OF THE FDR OF THE NS OTTO HAHN USING PSEUDOSTOCHASTICALLY MOVING CONTROL RODS. Weber, A. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany)). 1974. 106p. (In German). Dep. NTIS (US Sales Only) $8.50.

The reactivity balance of the OTTO HAHN reactor was perturbed by pseudostochastically driven control rods in order to determine the transfer functions between reactivity and thermal output (neutron flux), primary system pressure, and temperature at the center of a fuel element. The transfer functions were determined at power levels of 4.7, 32, and 37 MW(t) in the frequency range 2×10^{-3} to 3×10^{-1} Hz. The pseudostochastic signals discriminated against the non-linear behavior of the system and permitted the non-linearities to be identified. The pressure coefficient and the temperature coefficient were determined to a high degree of precision through least-squares fitting of transfer-function data to a theoretical model of the reactor. The differential reactivity worth of the control rods was also determined. (DG)

7712 ECONOMIC COMPETITIVE POSITION OF NUCLEAR CONTAINERSHIPS TODAY. Harrison, D. L.; Addae, A. K. (Howard Univ., Washington, DC). Trans. Amer. Nucl. Soc.; 19: 223-224(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Reactor Safety and Environmental Aspects

Refer also to abstracts 5964, 5965, 5970, 5976, 6004, 6365, 6785, 7328, and 7687.

7713 (ANCR-1165) SINGLE- AND TWO-PHASE PERFORMANCE CHARACTERISTICS OF THE MOD-1 SEMISCALE PUMP UNDER STEADY STATE AND TRANSIENT FLUID CONDITIONS. Olson, D. J. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)). Oct 1974. Contract AT(10-1)-1375. 96p. Dep. NTIS $5.45.

The performance characteristics of the Mod-1 semiscale pump were evaluated on the basis of data obtained from steady state single- and two-phase flow pump tests. In addition, data relative to the response of the Mod-1 pump to transient two-phase fluid conditions were obtained in conjunction with the isothermal blowdown tests conducted as a part of the Semiscale Blowdown and Emergency Core Cooling (ECC) Project. Complete single-phase performance characteristics of the pump are presented. Analysis of two-phase results is confined to the normal pump operating region, although limited steady state two-phase data are available for abnormal operating regions. The analysis resulted in a significant improvement in the understanding of single- and two-phase operating characteristics of the Mod-1 pump. (auth)

7714 (ANL-8059) NAHAMMER, A COMPUTER PROGRAM FOR ANALYSIS OF ONE-DIMENSIONAL PRESSURE-PULSE PROPAGATION IN A CLOSED FLUID SYSTEM. Chen, W. L.; Thompson, D. H.; Shin, Y. W. (Argonne National Lab., Ill. (USA)). May 1974. Contract W-31-109-eng-38. 52p. Dep. NTIS $5.45.

A numerical method for linear inviscid fluid-hammer analysis based on the method of characteristics is described. Analytical solutions of the wave equation are used in place of the compatibility equations of the more conventional method of characteristics. The numerical solution, which is obtained by a simple superposition technique for tracing the waves traveling along each characteristic, extends the solution from one constant time line to the next. Using the predetermined constant characteristic net, the spatial interpolation was eliminated, maintaining the pressure wave in its full amplitude in the numerical procedure. This contrasts to the case of a nonlinear problem in which the pressure peaks are always flattened in the interpolation procedure. The computer program NAHAMMER is a system-analysis code adequate for short-term pressure transients of most engineering problems of significance involving a moderate pressure source. It considers the simplified one-dimensional, linear inviscid set of governing equations with isentropic flow assumption. A closed fluid-network system is considered to be composed of a multiple of one-dimensional piping sections and components that are connected by various joints. NAHAMMER contains an ANL model for the molten-fuel/coolant interaction for specifying the source pressure. As a user's option, an alternative input of pressure-time history can also be provided as the source. NAHAMMER then follows the pressure pulses that propagate in the liquid sodium throughout the system network. The cavitation effect is precluded in the analysis by replacing any negative pressure by a saturation pressure. An analytical solution under an acoustic approximation was obtained, and the results showed a good agreement with the numerical solution. The code has been applied to complex geometries, and the results are presented. (auth)

7715 (ANL-CT-73-14) ANALYSIS OF PRESSURE PULSE PROPAGATION RESULTING FROM SODIUM–WATER REACTION IN HYDRAULIC NETWORKS. Shin, Y. W. (Argonne National Lab., Ill. (USA)). Jul 1973. 23p. Dep. NTIS $4.25.

Calculations were made for a partial rupture corresponding to a leakage rate of 1 lbm/sec and for the leak location at the upper end of the evaporator in the secondary sodium circuit of the EBR-II reactor. Two independent analysis methods, the arithmetic method of the Zaker and Salmon code and the method of characteristics of the NAHAMMER code were studied in detail and their relative merits are discussed. The NAHAMMER code, originally written for studying the molten fuel-sodium interaction, was converted to a sodium–water reaction code incorporating the same product-zone growth model for calculating the source pressure as developed by Zaker and Salmon. Results produced by the two codes are compared. The comparison shows a good agreement, and observed discrepancies in the two results are attributed mainly to the inherent differences between the two codes in the time steps taken and the manner in which the boundary conditions are handled. (DG)

7716 (BC-TOP-3-A(Rev.3)) TORNADO AND EXTREME WIND DESIGN CRITERIA FOR NUCLEAR POWER PLANTS. Rotz, J. V.; Yeh, G. C. K.; Bertwell, W. (Bechtel Power Corp., San Francisco, Calif. (USA)). Aug 1974. 66p.

Nuclear power plant design criteria for tornadoes and extreme winds are presented. Data, formulation, and procedures for determining maximum wind loading on structures and parts of structures are included. Extreme wind loading is applied to structures using methods and procedures consistent with the ANSI Building Code requirements A58.1-1972. Tornado wind loading is applied to structures using procedures paralleling those for extreme winds with additional criteria resulting from the atmospheric pressure change accompanying tornadoes and tornado missile impact effects. Parameters (velocities, pressure drop and geometry) defining the magnitude of the tornado upon which plant design is based are specified in the plant Safety Analysis Report (SAR). A cross reference listing of items related to Atomic Energy Commission Safety Analysis Report format is provided in Appendix A. Development supporting tornado criteria is included in Appendix C and Appendix D. (auth)

7717 (BC-TOP-4-A(Rev.3)) SEISMIC ANALYSES OF STRUCTURES AND EQUIPMENT FOR NUCLEAR POWER PLANTS. Topical Report. Tsai, N. C.; Hadjian, A. H.; Kuo, P. T.; Adair, M. J.; Morrow, W. M.; Yeh, G. C. K.; Sobkowski, S. L. (Bechtel Corp., San Francisco, Calif. (USA)). Sep 1974. 175p.

The current, general practice within Bechtel Power Corporation for the seismic analysis of nuclear power plant structures and components is presented. This includes the specification of design earthquakes, the establishment of mathematical models for structures and components, and the various applicable methods of computing seismic responses. Criteria on the use of the computed seismic response in conjunction with other applicable loads for the structural design are not included. (auth)

7718 (CENPD-67(Rev.1) and (Add.1)) IODINE DECONTAMINATION FACTORS DURING PWR STEAM GENERATION AND STEAM VENTING. Martucci, J. A.; Mayer, R. E.; D'Amaddio, E. R. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Nov 1974. 133p.

The emissions of radioactive iodine in saturated steam from a PWR vertical U-tube steam generator during normal and fault chemistry conditions are examined. Mechanical entrainment is concluded to be the controlling iodine transport mechanism in the steam phase. Operating experience and laboratory experiments substantiated that volatile forms of iodine do not occur in the steam generator. As a direct result of these studies, steam generator iodine decontamination factors should not be lower than a value of 400 for design basis studies or greater than 1000 for normal operation studies. (auth)

7719 (CENPD-140(Amend. 1)) DESCRIPTION OF THE CONTRANS DIGITAL COMPUTER CODE FOR CONTAINMENT PRESSURE AND TEMPERATURE ANALYSIS. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Nov 1974. 14p.

The CONTRANS digital computer program is described. This code calculates the transient response of the containment and annulus buildings to loss of coolant and main steam line break accidents. The model consists of mass, energy, and volume balances on the containment and annulus buildings. Mass and energy releases to the containment following an accident are code inputs. The model includes active heat sinks such as containment sprays, fan coolers, and shutdown cooling heat exchangers as well as the passive heat sinks such as the containment walls. A variety of wall heat transfer coefficients is available either as internal code functions or as code inputs. For long term NSSS energy release after the NSSS has reached pressure equilibrium with the containment, a model of the NSSS is included. This model includes decay heat, RCS and steam generator fluid stored energy and primary and secondary metal-to-coolant heat transfer. The annulus building model includes the containment vessel wall as a heat source and annulus walls as heat sinks. The change in the annulus building volume resulting from thermal and pressure expansion of the containment vessel wall is included. The annulus ventilation system is modeled. The differential equations used in the models are presented. In the simulation the equations are in finite difference form and are numerically integrated in time. Results from CONTRANS for typical loss-of-coolant accidents and main steam line breaks are given. The assumptions and conservatisms made in defining the containment design basis accident are given. (auth)

7720 (CENPD-141(Suppl. 1)) DDIFF CODE TOPICAL REPORT: STANDARD PROBLEM SUBCOMPARTMENT ANALYSIS. (Combustion Engineering, Inc., Windsor, Conn. (USA)). Oct 1974. vp.

Calculated data on PWR blowdown flow rates and pressure transients are presented. (DG)

7721 (COO-2152-9) INVESTIGATION OF PRESSURE DROPS AND HEAT TRANSFER COEFFICIENTS FOR LOSS OF COOLANT EVALUATION. Quarterly Progress Report, Period Ending September 1973. (Cincinnati Univ., Ohio (USA). Dept. of Chemical and Nuclear Engineering). [nd]. Contract AT(11-1)-2152. 27p. Dep. NTIS $4.50.

Progress in the study of pressure drop and heat transfer phenomena of importance during a loss of coolant accident is reported. The experiments include: (1) transient pressure drop investigation, (2) two-phase pressure drop and flow pattern study, and (3) transition boiling and reflooding heat transfer tests. (JWR)

7722 (EIR-263) DYNAMIC BEHAVIOR OF A GAS-COOLED FAST BREEDER REACTOR WITH DIRECT GAS TURBINE CIRCUIT, GIVEN AS AN EXAMPLE OF A PIPE FRACTURE INCIDENT IN A 1000 MW(e) PLANT WITH RECUPERATOR. Tiberini, A. (Eidgenoessisches Inst. fuer Reaktorforschung, Wuerenlingen (Switzerland)). Jun 1974. 208p. (In German). Dep. NTIS (US Sales Only) $13.50.

The improved economy of a gas-cooled fast breeder reactor installation of 1000 MW(e) with direct gas turbine circuit presents significant problems of safety. In order to be able to study the consequences of a sudden gas primary circuit break in a non-integrated variant, the dynamic behavior of the complete installation during the incident must be studied. The simulation was carried out with a model which contains the one-dimensional

differential equations of gas dynamics for a compressible gas and the differential equations of reactor kinetics with six groups of delayed neutrons. The gas turbines and condenser were incorporated as point elements in the calculations. The pressure and temperature distributions and the mass current were determined not only in the reactor core but also in the most important components (cooler and recuperator) and at the input and output of the turbine. The temperature distributions in the fuel and in the covering of a middle channel and in the tube walls of the cooler and recuperator were calculated at each moment. Of special importance is the time change in the number of revolutions of the turbine. It is shown that the pattern of the incident varies with the value of certain parameters and that under certain assumptions control of the reactor installation during the commencement of such an incident is still possible. A significant part of the solution method can be used in the calculation of transients in any gas-cooled nuclear power plant with closed circuits. (tr-auth)

7723 (IRS-F-21) REPORT ON THE RESEARCH PURPOSES IN THE AREA OF REACTOR SAFETY REQUIRED BY THE FEDERAL MINISTER FOR RESEARCH AND TECHNOLOGY. Quarterly Report for the Period April 1–June 30, 1974. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). Sep 1974. 275p. (In German). Dep. NTIS (US Sales Only) $16.75.

7724 (JUL-1098-RG) CONTAINMENT FOR HIGH-TEMPERATURE REACTORS UNDER SPECIAL CONSIDERATION OF SAFETY AND ENVIRONMENTAL ASPECTS. Kroeger, W. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Reaktorentwicklung). Aug 1974. 105p. (In German). Dep. NTIS (US Sales Only) $8.25.

Thesis. Submitted to Technische Hochschule, Aachen.

A survey on the importance of both the HTGR containment and its arrangement to ensure safe operation without adverse environmental effects is given. The ensuing problems and system requirements are indicated, and solutions are proposed. The total release path of radioactive fission products is illustrated, and the conditions which determine whether a release is permitted or prevented are discussed. The behavior of the containment under extremely strong external influences is discussed. The underground emplacement emerges as a possibility to handle heaviest accidents. A proposal for the lay-out of a process-heat reactor is presented. (DG)

7725 (ORNL-4979, pp 101-110) NUCLEAR REACTOR SAFETY STUDIES: EMERGENCY PLANNING FOR ACCIDENTAL RADIOACTIVITY RELEASES FROM A LICENSED NUCLEAR FACILITY. Chester, C. V.; Chester, R. O.; Haaland, C. M. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Two topics which determine the time available to institute emergency procedures after a water-cooled power-reactor core meltdown have been examined. First, a realistic calculation of fission product release as a function of time has been made. The release time function can determine, in part, the speed and type of response that is necessary. Second, the time-dependent meteorological dispersion and deposition of the radioactive aerosol released to the environment have been calculated. Inhalation dose as a function of time is also estimated because it is the immediate concern of emergency planning for the population surrounding a licensed nuclear facility. (auth)

7726 (ORNL-TM-4555) HETRAP: A HEAT TRANSFER ANALYSIS PROGRAM. Malang, S. (Oak Ridge National Lab., Tenn. (USA)). Sep 1974. Contract W-7405-eng-26. 51p. Dep. NTIS $5.45.

A digital computer code was developed for use in the evaluation of LOCA experiments. The major application of the code is to calculate heat flux and heat transfer coefficient at the surface of an electrically heated rod during a fast transient, using measured temperatures in the rod. In addition, the code can be used to calculate the steady-state and transient temperature fields in fuel rods and electrically heated rods for given heat transfer coefficients. (auth)

7727 (ORNL-TM-4633) TEMPERATURE DISTRIBUTION IN A 19-ROD SIMULATED LMFBR FUEL ASSEMBLY WITH AN EDGE BLOCKAGE (OUT-OF-REACTOR TEST FOR ANL FEFP P1 EXPERIMENT): RECORD OF EXPERIMENTAL DATA FOR FUEL FAILURE MOCKUP BUNDLE 5A. Fontana, M. H.; Gnadt, P. A.; Kress, T. S.; MacPherson, R. E.; Parsly, L. F.; Wantland, J. L. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 227p. AT.

A record is presented of unevaluated experimental data obtained from Fuel Failure Mockup (FFM) bundle 5A, which simulated the configuration of the Fuel Element Failure Propagation (FEFP) P1 experiment to be conducted by Argonne National Laboratory (ANL). Bundle 5A consisted of 19 electric cartridge heaters with outside diameters of 0.23 in. spaced by 0.056-in. wire wraps on a 12-in. pitch. At the edge of the bundle, the diameter of wire wraps was reduced to 0.028 in., so that the flow passages contiguous to the channel wall were reduced in cross-sectional area. A stainless steel blockage plate, attached 4 in. downstream from the start of the heated section, blocked approximately one-third of the flow cross-sectional area along two adjacent flats of the hexagonal duct. The purpose of this test series was to determine the efficacy of the blockage for inducing fuel failure in the FEFP P1 experiment and to preview thermal-hydraulic coolant behavior of the FEFP rod bundle. A description of the system, the experimental procedures, and tabulated data from the experiments performed in this series are included. (auth)

7728 (ORNL-TM-4738) HTGR SAFETY STUDIES PROGRESS REPORT FOR THE PERIOD ENDING DECEMBER 31, 1973. Sanders, J. P. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 41p. (GCR-DL-73-5). Dep. NTIS $5.25.

Progress is reported in the following areas: (1) thermal analysis and code development, and (2) cooling system performance during post shutdown operation. (JWR)

7729 (ORNL-TM-4752) HTGR SAFETY STUDIES PROGRESS REPORT FOR THE PERIOD ENDING JANUARY 31, 1973. (Oak Ridge National Lab., Tenn. (USA)). 1973. 24p. Dep. NTIS $4.25.

Progress is reported in the following areas: (1) thermal analysis and code development, (2) failure of coated fuel particles by mass transport in a temperature gradient, (3) coated particle performance modeling, (4) fission product transport, (5) reactivity effects, and (6) tritium distribution and release. (JWR)

7730 (ORNL-TM-4753) HTGR SAFETY STUDIES PROGRESS REPORT FOR THE PERIOD ENDING MARCH 31, 1973. (Oak Ridge National Lab., Tenn. (USA)). 1973. 41p. (GCR-DL-73-2). Dep. NTIS $5.25.

Progress is reported in the following areas: (1) thermal analysis and code development, (2) mass transport in coated fuel particles, (3) coated particle performance modeling, (4) fission product transport, (5) reactivity effects, and (6) tritium distribution and release. (JWR)

7731 (RD/B/N-2850) PROPAGATION OF THERMAL EXPLOSIONS. 1. Tin/Water Experiments. Board, S. J.; Hall, R. W. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.). Feb 1974. 7p. (CONF-731126-4). Dep. NTIS (US Sales Only) $4.00.

From 2nd specialist meeting on sodium fuel interaction in fast reactors; Ispra - Varese, Italy (21 Nov 1973).

The occurrence of large-scale high efficiency thermal explosions suggests that the reaction rapidly propagates through the available material. Some experiments with molten tin and water have been performed which show that such spatial propagation can occur through self-driven vapor blanket collapse. It is shown that the explosive release of energy is associated with rapid fragmentation and mixing rather than superheating of the surrounding water. It is suggested that the fragmentation may be due to the Taylor and Kelvin-Helmholtz instabilities arising from the rapid motion of the interaction front, and that in favorable circumstances this fragmentation may be sufficient to maintain the pressurisation and growth of the interaction region. (auth)

7732 (RISO-M-1740) SEQUENTIAL EFFECTS IN FAILURE MODE ANALYSIS. Taylor, J. R. (Danish Atomic Energy Commission, Risoe. Research Establishment). Aug 1974. 37p. (CONF-740906-4). Dep. NTIS (US Sales Only) $5.00.

From conference on reliability and fault tree analysis; Berkeley, California, USA (3 Sep 1974).

In systems which involve sequential control, standby safety systems, and safety shut down procedures, the sequence of actions is important in describing normal operation. Event sequence is also important in describing failures in such systems in many cases. Several examples can be given. Cause-consequence analysis techniques are especially useful for studying such systems, firstly because they offer a systematic way of building a mathematical model of the failure process; and secondly, because "sequence" is treated naturally by the method. A third advantage is that many different consequences (TOP events) can be treated together, using the same analysis. Cause-consequence analysis can be formalized, to provide a semiautomatic method of failure mode and effects analysis. The "plant" is represented by a block diagram, with arcs representing causational links, and the blocks being described by arithmetic or logical transfer functions. A "condition" is a predicate which restricts the possible states of a system (usually

by restricting the range of values of a single system variable). An "event description" is a pair of conditions, one of which is true before the event time, the other true after the event time. Event sequences can be traced through the block diagram of the system, using techniques developed for automatic theorem proving to deduce the next event at each block. (auth)

7733 (STF-60-A74044) NUCLEAR POWER PLANT IN THE OSLOFJORD DISTRICT. Report 11. Lower Density Surface Release. An Evaluation of the Individual Release Parameters' Influence on the Release. Audunson, T.; Thendrup, A. (Trondheim Univ. (Norway). Vassdrags- og Havnelaboratoriet). 25 Mar 1974. 85p. (In Norwegian). Dep. NTIS (US Sales Only) $7.25.

The dispersion and dilution of surface-discharge effluents with a lower density than the recipient are discussed. Diagrams are presented showing how changes in the discharge duct's shape and size influence the dispersion and dilution. Stagnant conditions, current, and the effect of wind in the recipient have been considered. It is shown that considerable variations in the anticipated influence on the recipient of a given amount of effluent may be achieved by changes in the geometry of the discharge duct. (NO)

7734 (TID-26665) REPORT ON RELEASES OF RADIOACTIVITY IN EFFLUENTS AND SOLID WASTE FROM NUCLEAR POWER PLANTS FOR 1972. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Aug 1973. 67p. Dep. NTIS $6.50.

A tabulation of radioactivity in effluents and solid waste from nuclear power plants for calendar year 1972 is presented. The data included are those reported by the licensee except for certain calculations made by the Regulatory staff. A similar report was made for 1971. The radioactivity in effluents from licensed nuclear power plants has generally been low in comparison with the limits set forth in the Atomic Energy Commission's Part 20 of Title 10, Chapter 1, Code of Federal Regulations (10 CFR Part 20), "Standards for Protection Against Radiation." (auth)

7735 (UCRL-51619) EVALUATION OF THE USE OF SEISMIC SCRAM SYSTEMS FOR POWER REACTORS. Tokarz, F. J.; Zaslawsky, M.; St. Leger-Barter, G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 19 Jul 1974. Contract W-7405-eng-48. 26p. Dep. NTIS $4.00.

The feasibility of producing a meaningful and highly reliable seismic signal to be used to initiate an automatic seismic scram system on nuclear power reactors is evaluated. Earthquake characteristics required to distinguish damaging from nondamaging ground motions are examined. Available seismic detection instrumentation is described and its reliability discussed. Some comments on the use of earthquake statistics and probability techniques to determine the frequency of occurrence of various intensities of ground motion are included. The most promising seismic scram system that could be designed using present technology is described. (auth)

7736 (WCAP-8353) SAFETY RELATED RESEARCH AND DEVELOPMENT FOR WESTINGHOUSE PRESSURIZED WATER REACTORS. Program Summaries. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Spr 1974. 64p.

Progress is summarized for the following areas: (1) fuel development program for operator at high power densities, (2) in-core detector program, (3) full length emergency cooling heat transfer system effects tests, (4) reactor vessel thermal shock program, (5) delayed departure from nucleate boiling testing, (6) acoustical monitoring program, (7) steam/water mixing tests, and (8) process development program for minimizing inpile fuel densification. (JWR)

7737 (WCAP-8404) ANTICIPATED TRANSIENT WITHOUT TRIP ANALYSIS FOR WESTINGHOUSE PWRs WITH 44 SERIES STEAM GENERATORS. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Sep 1974. 358p.

The AEC Regulatory Staff licensing position on Anticipated Transients Without Trip (ATWT) is set forth in WASH-1270, "Technical Report on Anticipated Transients Without Scram for Water Cooled Power Reactors." To satisfy the position set forth in WASH-1270, anticipated transients were analyzed for Westinghouse PWR's with the unrealistic assumption that a hypothetical, undefined common-mode failure prevents reactor trip. These analyses were performed on a generic basis using appropriate parameters representative of operating characteristics of Westinghouse PWR's. The analyses apply to Westinghouse PWR's equipped with 44 Series steam generators. The results show that in all cases the DNB ratio is greater than 1.0, and the peak Reactor Coolant System pressure does not reach a value which would impair the mechanical integrity of the system. The radiological consequences calculated for these postulated events are well within the guideline values set forth in 10 CFR Part 100. (auth)

7738 (WCAP-8420) ANTICIPATED TRANSIENT WITHOUT TRIP ANALYSIS FOR A 2-LOOP WESTINGHOUSE PWR WITH MODEL D STEAM GENERATORS AND A 16 × 16 FUEL ARRAY. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Oct 1974. 124p.

The AEC Regulatory Staff licensing position on Anticipated Transients Without Trip (ATWT) is set forth in WASH-1270, "Technical Report on Anticipated Transients Without Scram for Water Cooled Power Reactors." To satisfy the position set forth in WASH-1270, anticipated transients were analyzed for Westinghouse PWR's with the unrealistic assumption that a hypothetical, undefined common-mode failure prevents reactor trip. These analyses were performed on a generic basis using appropriate parameters representative of operating characteristics of 2-loop Westinghouse PWR's with Model D steam generators and a 16 × 16 fuel array. The results show that in all cases the DNB ratio is greater than 1.0, and the peak Reactor Coolant System pressure does not exceed the allowable pressures given in Appendix C of WCAP-8330. The radiological consequences calculated for these postulated events are well within the guideline values set forth in 10 CFR Part 100. (auth)

7739 (XN-73-34(Rev.2)) HUXY: A GENERALIZED MULTI-ROD HEATUP CODE. Steves, L. H.; Gaines, S. F.; Kahn, J. D. (Exxon Nuclear Co., Richland, Wash. (USA)). Oct 1974. 147p.

The HUXY code is used for predictive and post-test analysis of the thermal response of a fuel assembly during the core heatup and ECCS actuation stage of a loss-of-coolant accident in a light water power reactor. HUXY is a modification and improvement of the original MOXY code. The theoretical foundations of the code are presented and a sample problem input and output listing is given. (JWR)

7740 (XN-74-25(Rev.1)) 2DQ: A TWO DIMENSIONAL QUENCHING MODEL FOR REWETTING OF HOT SURFACES IN A LOSS OF COOLANT ACCIDENT. Kahn, J. D.; Steves, L. H. (Exxon Nuclear Co., Richland, Wash. (USA)). 30 Oct 1974. 96p.

A complete two-dimensional model which describes the advancement of the rewetting front during the emergency core cooling of a light water reactor is presented. The application of the model to loss of coolant accident analysis is discussed. (JWR)

7741 POWER SUPPLY FOR THE ECCS OF BOILING WATER COOLED REACTORS. Cernovec, A. K.; Barabuskin, V. A.; Petrov, J. A. (Leningradskij Politekhnicheskij Inst. (USSR); Projektierungsbuero fuer Waermekraft und Elektrische Anlagen, Leningrad (USSR)). Arch. Energiewirt., 28: No. 14, 711-719(Jul 1974). (In German).

5 figs.; 1 tab.; 2 refs. With abstract in German.

In order to control the consequences of a rupture of the primary coolant circuit, an emergency core cooling system (ECCS) is provided which supplies sufficient water to cool the core. One of the most important problems is the development of a power supply for the ECCS. The supply must also be guaranteed if a fault in a technological part coincides with a sudden power failure. The emergency safety systems must come into action within 30 seconds or they will be ineffective. (GE)

7742 HAS FAILURE OF SAFETY SYSTEMS IN THE WUERGASSEN NUCLEAR POWER PLANT BEEN ABNORMAL. IRS Mitt.; No. 1, 23-28(Mar 1974). (In German).

1 ref.

The abnormal occurrences at Wuergassen are investigated and shown that despite the disturbances, at no time were the reliable shutdown and emergency cooling of the reactor plant as well as the safe containment of radioactive materials in doubt. There was never any danger to the population or to the environment. (GE)

7743 STATIC AND DYNAMICAL PROBLEMS IN CONSTRUCTION AND DESIGN OF NUCLEAR POWER PLANTS. Klang, H. (Dyckerhoff und Widmann A. G., Muenchen (F. R. Germany)). Beton Stahlbetonbau; 68: No. 11, 265-268(1973). (In German).

6 figs.; 5 refs.

The theoretically determined effects of the maximum credible accidents (MCA) such as a plane crash on a nuclear power plant, occurrence of a pressure wave on the exterior front of the reactor building or rupture of a primary circuit, determine the shape and measurements of whole construction units. The particular problems which confront the civil engineer are summarized. (GE)

7744 PROFUSION: A COMPUTER CODE TO EVALUATE REACTIVITY CHANGES DUE TO MOLTEN FUEL SLUMPING AND SOLID FUEL COLLAPSE. Renard, A.; Stievenart, M. (Societe Belge pour l'Industrie Nucleaire, Brussels). pp 1285-1302 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The code PROFUSION was initially developed to evaluate the reactivity changes which could be associated with molten fuel slumping in an oxide fueled fast reactor with two enrichment zones. The code calculates in a two-dimensional mesh the creation of central voids resulting from the migration of porosities inside oxide fuel pins, the propagation of fuel melting as a result of overpower or undercooling, and the displacement of molten fuel in the central voids according to several schemes. In transient conditions, the latent heat of fusion can be taken into account by means of a "melting front" movement. The reactivity effects are evaluated by means of a perturbation formula using a 2D fuel reactivity worth distribution and are validated by neutron diffusion calculations. The solid fuel collapse is related to the interactions between fuel and cladding during the reactor operation at nominal conditions. At the time of power reduction, distributed voids or lower fuel linear density can appear in some core regions due to the different contraction of fuel and cladding. A hazardous situation is the sudden collapse of all those voids in the whole reactor core. The PROFUSION 2 code evaluates the potential reactivity effect stored in the core. Several criteria of fuel-cladding attachment are considered as well as the influences of the fuel plasticity and the swelling due to burnup. A parametric survey is provided for the EFFBR oxide core project with dished and undished pellets and also for a 300 MW(e) LMFBR. A tentative comparison of the model with experimental measurements of zero-to-full power reactivity effect in the 20–24 MW(t) RAPSODIE reactor core at several burnups is presented. A good agreement between the measured values and the theoretical model of interaction is obtained for high burnups where the assumption of fuel-cladding attachment is quite credible. (auth)

7745 SIMULATED MELTDOWN AND VAPOR EXPLOSION EXPERIMENTS IN ZEBRA 8G AND ZEBRA 12 AND THEIR INTERPRETATION. Collins, P. J.; Ingram, G.; Codd, J. (Atomic Energy Establishment, Winfrith, Eng.). pp 1303-1320 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Two series of measurements have been made in ZEBRA to test the calculation methods for the reactivity increments produced in various hypothetical accident configurations. These configurations involved compaction and displacement of the fuel coupled with the loss of sodium, leaving large void regions in the core. The first set of experiments was made in ZEBRA 8G, which contained a large central zone with axial dimensions and composition representative of a power reactor, surrounded by a uranium/graphite driver region. Axial displacements of materials were studied in a central region with radial cross-section slightly larger than that of a power reactor sub-assembly. These included compaction of the fuel on top of the lower axial breeder and compaction of fuel at the core center, with sodium expelled. The experiments were analyzed with a transport theory code, and good agreement was found. A second series of studies was made in a more realistic power reactor mock-up, ZEBRA 12. This included an additional central "meltdown" experiment with axial fuel displacement, similar to that in ZEBRA 8G but with improved representation of the void region. The second experiment was a simulation of a vapor explosion configuration in a region at the core/radial-breeder interface. The configuration simulated radial compaction of fuel and breeder material over the full core height with expulsion of sodium, leaving a void of cross-section approximately 220 mm square. The measurements were made with several intermediate stages to assist in the interpretation of the effects taking place. These experiments have been analyzed using diffusion theory in XYZ geometry using anisotropic modified diffusion coefficients to take into account axial and radial streaming. (auth)

7746 STUDENT SCIENCE TRAINING IN NUCLEAR POWER AND THE ENVIRONMENT. Angelo, J. A. Jr.; Garrett, W. R.; Woodbridge, D. D. (Florida Inst. of Tech., Melbourne). Trans. Amer. Nucl. Soc.; 19: 34-35(1974).

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7805 SEISMIC ANALYSIS OF SLENDER BURIED BEAMS. Yeh, G. C. K. (Bechtel Power Corp., Los Angeles). Bull. Seismol. Soc. Amer.; 64: No. 5, 1551-1562(Oct 1974).
Nuclear reactor facilities often include segments of long tubular structures such as cooling water intake conduits, electrical ducts, and water well casings that are buried underground. During an earthquake such a buried structure responds to various seismic waves propagating through the surrounding soil as well as to the dynamic differential movements of the buildings to which the structure is connected. A rigorous analysis of the problem should consider the time-dependent stresses in the structure due to all the causes simultaneously. Such an analysis is beyond current technology. A procedure to estimate the stresses due to various effects separately and then to combine them properly for design purposes is presented. The resulting stresses can then be combined further with other applicable stresses to satisfy the design requirements. The analysis assumes that the soil is linearly elastic and homogeneous and the structure is a straight slender solid or hollow beam with a uniform, symmetrical cross section that satisfies the conditions of the elementary theory of slender beams. (auth)

7806 SOME PROBLEMS ABOUT SAFETY OF NUCLEAR POWER STATION. Anzai, I. (Tokyo Univ. (Japan). Faculty of Medicine). Genshiryoku Kogyo; 22: No. 2, 31-36(Feb 1974). (In Japanese).
During the past two years, more than ten accidents, failures and defects in light water type nuclear power stations have been disclosed in Japan. A part of them relates to the safety concerning reactor engineering. Problems are the failure of zircaloy-clad fuel and the defects generated in reactor pressure vessels and steam generators. Emergency core cooling system also seems to be a problem because its performance reliability is not established experimentally. In the field of workers' exposure to radiation, practically no effective control system has been determined for the subcontractors who carry out the works of potential exposure and/or contamination, for example, regular check-up. For plant workers, permissible dose to them may be a problem when the future increase of plant capacity is considered, while ICRP has proposed to reduce the permissible dose per year. Environmental radiation dose and warm water discharge are also left unsolved. These problems must not be discussed separately, but treated as a whole in the Japanese policy on energy. (JA)

7807 SAFETY ASSESSMENT AND PROBABILITY THEORY ON NUCLEAR POWER REACTOR. Togo, Y. (Tokyo Univ. (Japan). Faculty of Engineering). Genshiryoku Kogyo; 20: No. 3, 24-28(Mar 1974). (In Japanese).

One important means to ensure the safety of nuclear power plants is safety assessment, by which it is confirmed that environmental and siting criteria are satisfied. In seeking the theoretical basis for this safety assessment, the theory of probability must inevitably be relied on. Reviewing the world trends in this connection, the following are described: the siting criteria based on probability theory adopted in the U.K. and Canada; probability theory utilized for the DBA of a plane crash on a nuclear power plant in the United States; the risk level to society considered in various countries; and problems involved in the probability treatment of the safety assessment. (JA)

7808 THE PRESENT STATE OF NUCLEAR POWER GENERATION AND ITS TRENDS. Hirano, Mutsuhiro (Ministry of International Trade and Industry, Tokyo (Japan)). Haikan Gijutsu; 16: No. 1, 150-163(Jan 1974). (In Japanese).

The recent development of nuclear power generation is very remarkable. It is expected to play an important role in future energy resource problems, especially concerning current energy crisis and environmental pollution. However, the problems involved in it are many, including safety, conservation of environment, stabilized fuel supply and waste disposal. The following are described: the need for nuclear power generation and outlook; the trends of power reactors; problems of nuclear fuel; the safety of nuclear power generation and environmental problems; and the trends of waste treatment and disposal. (JA)

7809 HIGH SPEED TWO-PHASE FLOW, (4). Two-Phase Discharge Coefficient of Large Sharp-Edged Orifice. Adachi, Hiromichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Nippon Genshiryoku Gakkaishi; 16: No. 6, 322-329(Jun 1974). (In Japanese).

The two-phase discharge coefficient C_D of a large sharp-edged orifice was derived experimentally from the ROSA-1 data of the Japan Atomic Energy Research Institute. These orifices are used for predicting the discharge flow rate in the event of a loss-of-coolant accident occurring in a light water nuclear reactor. In this analysis, x_0, the transient value of the quality of the discharged fluid in the high pressure reservoir is calculated from the reservoir pressure P_0 and the weight w of the residual fluid, using the "depressurization rate method". Furthermore, the standard value of the two-phase critical weight velocity G_C is obtained with use of the author's theory. The relation between C_D and x_0 varies markedly according to the quality. When x_0 is not so small, C_D is determined only by the orifice diameter D, and does not vary with x_0 or P_0. When x_0 approaches zero, C_D increases sharply, reaching a value of 1.5. At the same time it increases slightly with decreasing P_0 and with decreasing D. (auth)

Reactor Theory and Calculation

Refer also to abstracts 7366, 7535, 7561, 7574, 7593, 7595, 7604, 7645, 7654, 7661, 7673, and 7915.

7810 (BARC-753) FAST REACTOR PHYSICS ANALYSIS. Kapil, S. K.; Trasi, M. S. (Bhabha Atomic Research Centre, Bombay (India). Reactor Engineering Div.). 1974. 177p. Dep. NTIS (US Sales Only) $12.00.

A broad range of topics on the physics of fast reactors is covered. Important aspects of calculational techniques are discussed. Included are multigroup diffusion equations, transport equation solutions, perturbation, and reactivity coefficients. (DG)

7811 (LA-5745-MS) FCFTR: A COMPUTER CODE TO CONVERT STANDARD CCCC INTERFACE FILES TO FTR FILES. Soran, P. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1974. Contract W-7405-eng-36. 16p. Dep. NTIS $4.00.

The FCFTR code has been developed to permit translation of ISOTXS and BRKOXS of the Committee on Computer Code Coordination (CCCC) interface system to FTR files. The code is written in ANSI FORTRAN and is operational on the CDC 7600. (auth)

7812 (TRG-REPORT-2547(R)) SOLUTION OF THE MULTIGROUP NEUTRON TRANSPORT EQUATION USING SPHERICAL HARMONICS. Fletcher, J. K. (UKAEA Reactor Group, Risley). Aug 1974. 23p. Dep. NTIS (US Sales Only) $4.00.

A method of solution of the multigroup transport equation is presented for one-, two-, and three-dimensional geometries. Some numerical results are also included. (auth)

7813 ON THE PROBLEM OF FINDING PROMISING METHODS AND WORKING MEDIA FOR NUCLEAR POWER PLANTS. Gochstein, D. P.; Tetelbaum, S. D. (Odesskij Politekhnicheskij Inst. (Ukrainian SSR)). Arch. Energiewirt.; 28: No. 15, 754-760 (Aug 1974). (In German).

3 figs.; 3 tabs.; 12 refs. Translated from Izv. Vuzov SSSR, 1974, v. 17(1), p. 57-62.

Thermodynamic cycles are taken as an example to study the electric efficiency of power plants using various working media (water, helium, CO_2). As a result of the investigations, it is proposed to look for components with low boiling point and for methods of improving the efficiency of the cycle with circulation of mixtures. (GE)

7814 DEVELOPMENT AND STATUS OF THE EVALUATED NUCLEAR DATA FILE ENDF/B. Pearlstein, S. (Brookhaven National Lab., Upton, NY). pp 603-611 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The Evaluated Nuclear Data File (ENDF) is part of a system developed by the US AEC to improve the quality and facilitate the use of nuclear data in applications. The basic elements of the ENDF system are shown. The widespread use of a single well-defined format reduces the number of schemes necessary to process information or compare alternate data sets. The existing network of checking codes that examine the consistency of the data sets and perform physical checks against known nuclear properties helps to ensure the reliability of the file. There are large processing codes that use ENDF directly to prepare multigroup constants or pointwise data sets required for one- two- and three-dimensional diffusion theory, transport theory, or Monte Carlo calculations. The entire ENDF library consists of two parts, A and B. ENDF/A contains a large and varied collection of evaluations from many sources. It is assembled by the National Neutron Cross Section Center. The contents of the present version of ENDF/A are shown. The ENDF/B library, on the other hand, contains only one evaluation of the cross sections for each material in the library, and cross sections for all significant reactions that extend well into the MeV range. Versions A and B of the ENDF library use the same format. Only the contents of the two libraries differ. ENDF/B includes data important for fast reactor calculations, but the lack of experimental information sometimes requires reliance on nuclear models or systematics to complete the file. For certain applications ENDF/B is tested in carefully performed and documented benchmark experiments. The information from such integral experiments as well as the results of basic cross section measurements are used to determine ENDF revisions on a periodic basis. (auth)

7815 NUCLEAR DATA AND INTEGRAL MEASUREMENT CORRELATION FOR FAST REACTORS. Gandini, A.; Petilli, M.; Salvatores, M. (CNEN, Casaccia, Italy). pp 612-628 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

In recent years quite a large literature has been written on the correlation between nuclear data and integral measurements obtained from fast critical assemblies. The statistical foundations are briefly recalled, and the most commonly used methods are analyzed. Emphasis is given to those arguments which are concerned with systematic error search. The main result is that nothing can be done if systematic errors are present in the integral experiments. When errors exist within the differential data, some indication may be obtained by properly exploiting the integral information. In this sort of assessment human judgement appears to play an essential role. For the application of these methods of correlation, the calculational codes MARA and AMARA have been written. The first one adopts the so-called method by elements, the second one a method using the Lagrange multipliers. A number of numerical cross-checks show the excellent reliability of the results for a class of problems of interest in practical cases. A method of correlation between the basic nuclear parameters and the integral data, consistent with the group cross-section generation program adopted, is proposed. Its main advantage is its independence from the group schematization chosen and, consequently, its flexibility with respect to practical cross-section collapsing requirements. (auth)

7816 MEASUREMENTS OF FAST NEUTRON SPECTRA IN IRON, URANIUM, AND SODIUM-IRON ASSEMBLIES. Kappler, F.; Pieroni, N.; Rusch, D.; Schmidt, A.; Wattecamps, E. (Kernforschungszentrum, Karlsruhe, Ger.). pp 883-907 of Proceedings

of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Spectrum measurements were performed at the fast subcritical facility SUAK to test nuclear data and computer codes used in fast reactor calculations. In order to obtain a specific and quantitative interpretation of discrepancies between measured and calculated spectra, homogeneous assemblies consisting of single materials were investigated. The leakage spectrum of iron and uranium cylinders was measured by time-of-flight and proportional counters. Time-dependent leakage spectra were measured by a NE 213 liquid scintillator. It was demonstrated that the investigation of time-dependent spectra is a sensitive test of inelastic scattering cross section data. The effect of an interface on fast neutron spectra was also investigated by measuring space dependent spectra across a sodium-iron interface. The measured spectra of these assemblies are suitable for testing the adequacy of computational approximations and cross section data. (auth)

7817 APPLICATION OF THE PULSED NEUTRON METHOD FOR INVESTIGATION OF FAST REACTOR PHYSICS CHARACTERISTICS. Stumbur, E. A.; Matveenko, I. P.; Avramov, A. M.; Egorov, Yu. E.; Zhuravlev, V. I. (State Committee on the Utilization of Atomic Energy, Obninsk, USSR). pp 1075-1095 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Principal aspects characterizing a possibility to measure kinetic parameters of large fast reactors by means of a time-dependent neutron flux stimulated by a pulse source are considered. On a set of reactor critical assemblies BFS-1 and BFS-2 (simulating large fast power reactors) an investigation of quasi-asymptotic neutron fields in a wide range of subcriticalities has been carried out. Volumes of the cores varied (up to 2000 liters) as well as the enrichment (from 20% up to 90% U-235). A standard reflector of natural uranium dioxide was used. Different methods of subcriticality creation (removal of full elements from a core, their replacement by reflector elements or boron-containing control rods) were used. Utilization of multichannel recording equipment with high resolution and a set of various detectors (fission chambers with U-235 and U-238, boron counters, scintillation sensors) permitted an investigation of the total picture of a time-dependent neutron field. The experiments show a possibility of the separation of the neutron flux quasiasymptotic behavior stage, whose decay constant can be a suitable measure of negative reactivity. With the methods of subcriticality creation used, a small variation of prompt neutron generation time was observed. It makes the pulsed α-method applicable for reactivity measurement in the range up to 10 to 15 β_{eff}. Some perspectives of pulsed method application for reactivity measurements at assembling and at overloading of fast power reactors (of the BN-350, BN-600 types) are considered. The results of measurements obtained by the pulsed method are compared with those obtained by Rossi-α method and with multigroup numerical calculation for the models of the reactors being investigated (including the total picture of non-stationary neutron distribution transient process). The role of slowly decaying flux of low energy neutrons accumulated in the reflector is underlined as a limiting factor for separation of the pseudofundamental harmonic. An evaluation is made of the accuracy of the determination of the kinetic parameters and other physical values with the help of the pulsed method. (auth)

7818 NUMERICAL METHOD FOR FAST REACTOR KINETICS EQUATIONS. Cecchini, C. P. (Progettazioni Meccaniche Nucleari, Genoa); Meda, N.; Galligani, I.; Valente, V. pp 1096-1113 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The numerical solution of the space-dependent reactor kinetics equations has been receiving increasing attention in recent years. For problems in one and two space-dimensions, different approximate methods have been developed, and also some general codes have been written. All these methods have been oriented to obtain the solution of these problems in reasonable computing time. For this reason, particular attention has been given to alternating-direction methods in the case of two space-dimension problems. A general method of solution for the two-dimensional multigroup kinetics equations which is numerically stable, accurate, and rapid in operation is presented. This method is an extension of the two-dimensional case of the Cohen–Flatt method for the point kinetics equations and of the Andrews–Hansen method for the one-dimensional kinetics equations. The numerical properties of this method are fully described. As a check of the method, some significant localized accidents have been studied for the PMN 1000 MW(e) reference reactor design. To reduce the computing time only two energy groups have been adopted, and the delayed neutron source has been considered time-independent for any rate of increase of the prompt neutron fluxes. The results obtained are shown and discussed. (auth)

7819 ONE-DIMENSIONAL FAST NEUTRON SPECTRUM CALCULATIONS BASED ON THE NEW CONTINUOUS SLOWING DOWN MODEL. Ito, S.; Yamamoto, H. (Hitachi Ltd., Kawasaki, Japan). pp 705-727 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Recent work in applying the continuous slowing down theory to fast reactor spectrum calculations has successfully demonstrated its usefulness in the representation of fine spectra and in the extreme reduction of computation time. However, these calculations are restricted to the space-independent neutron spectra. An extension to space-dependent problems has been attempted with the use of a newly derived continuous-slowing-down model typical of the Greuling–Goertzel equation. The numerical treatments, in space-dependent problems, consume surprisingly much time to obtain the results corresponding to the fine or ultra fine group spectra. The continuous-slowing-down equation is based on the one-dimensional diffusion equation for multi-region reactors in plane geometry. This new equation is solved by applying the Laplace transformation on a space variable. As compared with the age-diffusion equation, the rigorous inversion of this Laplace-transformed equation is very difficult to solve analytically in general. It is proposed that the expression of this inversion be described by means of an infinite number of age-like solutions employing the age defined by the second moment of the space of the Greuling–Goertzel diffusion equation. Thus, the analytical approach is easily realized. After some manipulations, the continuous-slowing-down equation is transformed into the integral equation of the lethargy u for the unknown flux and current at the outermost boundaries of a reactor. The flux and current in a region are determined with the aid of the transfer matrix, as in the case of the Lie-series method. The spectrum calculations based on this method have been compared with fast neutron spectrum measurements in an iron assembly carried out using the KURRI Linac. Microscopic features of the calculated spectrum are in good agreement with measured values in the intermediate energy region (30 keV < E < 1 MeV). (auth)

7820 ANALYTICAL APPROACH TO FAST NEUTRON SPECTRA BY THE MODIFIED WIGNER APPROXIMATION. Yamamura, Y. (Okayama Coll., Japan); Yamamoto, K.; Sekiya, T. pp 728-744 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The Wigner-type continuous slowing down (CSD) theory is applied to the treatment of elastic and inelastic moderation of fast neutrons in a fast reactor assembly and to the analytical treatment of the space-dependent neutron spectrum in a finite bulk medium. An analytical solution of neutron fluxes in a finite bulk medium is obtained by solving the proposed modified one-dimensional diffusion equation. It is represented in terms of the slowing down kernel which is analytically obtained. The analytical formula permits simple analyses of fast neutron time-of-flight measurements in a finite bulk medium. Comparison between the calculated spectrum and the measured one is satisfactory. The calculation results predict very well the fine structure of the measured spectrum. Numerical calculations are performed for various media containing resonant elements, and it is shown that this approach gives very accurate space-independent solutions for a representative fast reactor composition. The practical interest of this method is its rapid convergence. (auth)

7821 FAST REACTOR PHYSICS AT CEA. Bouchard, J. (CEN de Fontenay-aux-Roses, France); Darrouzet, M.; Robin, M.; Barre, J. Y.; Gourdon, J. pp 767-789 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

To reduce the uncertainties of the higher plutonium isotope cross sections, especially for the atomic masses 240 and 241, a program based on the following four types of experiments has been pursued: (1) experimental comparisons of the neutron balance in lattices which differ only by the isotopic composition of the plu-

tonium, (2) measurements of the effective fission cross sections of the plutonium and transplutonium isotopes by fission chambers in all the lattices, (3) reactivity measurements by an oscillation technique using small samples in several lattices, and (4) measurements of the effective capture cross sections for these isotopes by irradiation in several spectra and mass spectrometric analyses. The results obtained from these experiments and the corrections deduced for the integral cross sections are presented. Among the problems related to the burnup, the fission product capture cross section must be considered as one of the most important sources of uncertainty for a large power reactor at the equilibrium stage. It has been decided to measure directly the global effect of fission products by oscillating irradiated fuels. The lattices in which the fuel is oscillated allow direct use (in the power reactor) of the global adjustment of the fission product data deduced from these measurements. The checking of the experimental program and the adjustment of burnup calculations are related to irradiated fuel measurements. This includes the determination of the burnup rate from neodymium analysis and gamma spectrometry, and the study of the variation of the heavy isotope composition for some core or blanket fuel pins. A complete program has been performed at RAPSODIE leading to a first set of results to adjust burnup calculations. The contribution of such an approach is demonstrated for RAPSODIE, but the principal interest is for PHENIX, where the same experiments are planned. (auth)

7822 ADJUSTED CROSS SECTION LIBRARY AGLI AND RELIABILITY OF ANALYSIS OF INTEGRAL DATA. Kuroi, H.; Mitani, H.; Koyama, K.; Tone, T.; Hirota, J. (Japan Atomic Energy Research Inst., Tokai). pp 1188-1206 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Adjustment of the 1950 energy group cross section library AGLI is carried out using information obtained by the LSQ-method incorporated with 32 data of k_{eff} measurements and 32 data of reaction rate measurements. To elude difficulties in error estimation of cross section data, which is essential in the LSQ-method, the LSQ-adjustment is utilized in two steps: an appropriate set of differential data is selected, then the selected set is adjusted within relatively small random errors. The following conclusions were reached from performance testing of the adjusted library AGLI/2: the adjusted data on AGLI/2 are consistent with differential measurements of cross sections, and it is proven that AGLI/2 and the computer code system DOYC can predict various integral data with about the same accuracy as those measured by integral experiment. (auth)

7823 USE OF THE 2000 ENERGY GROUP REACTOR PHYSICS CODE MURAL IN THE INVESTIGATION OF SPECIAL EFFECTS IN FAST REACTORS. Macdougall, J. (Atomic Energy Establishment, Winfrith, Eng.). pp 1172-1187 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The standard method of calculating fast reactor neutronic properties is to perform a whole reactor calculation in a small number of neutron energy groups. The cross-sections for each zone of the reactor should take into account correctly the heterogeneity of the reactor zones and the neutron spectrum within each energy group. In practice some approximation is required in producing these cross-sections, resulting in errors and uncertainties in the reactor calculation. The use of the 2000 energy-group space dependent neutronics code MURAL B to investigate the accuracy of standard calculations is described. Topics investigated include: (1) studies of the effects of heterogeneity in plate lattices in ZEBRA, (2) variation of the neutron spectrum within the energy group in the neighborhood of a boundary between two reactor zones, (3) the effect of streaming in plate lattices, and (4) resonance shielding in heterogeneous lattices. (auth)

7824 PRODUCTION AND PERFORMANCE OF THE ADJUSTED CROSS-SECTION SET FGL5. Rowlands, J. L.; Dean, C. J.; MacDougall, J. D.; Smith, R. W. (Atomic Energy Establishment, Winfrith, Eng.). pp 1133-1152 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

A new fast reactor fine group cross-section library, FGL5, was produced in the summer of 1972. From this library a broad group set, FD5, was derived for PFR and CFR studies. The fine group library was adjusted to fit a wide range of integral experiments. It was based on an unadjusted library, FGL5U, which contains new evaluations for all the important cross-sections completed during 1971. The integral properties included in the cross-section adjustment studies were: (1) k-effective values in uranium and plutonium fueled critical assemblies, (2) k-infinity measured in null-reactivity test zones, (3) buckling values measured in central regions of critical assemblies, (4) central reaction rate ratios F_8/F_5, F_9/F_5 and C_8/F_5, (5) spectrum measurements at the center of critical assemblies and null-reactivity test zones, and (6) small-sample reactivity perturbation measurements. The adjusted set was produced in three stages. It was found that the most significant adjustments required were to U-238 capture and fission. To provide a better basis for further adjustment studies a new set, FGL5U*, was produced in which just these two cross-sections were changed. A new evaluation of U-238 resonance data was made to provide a resonance parameter basis for this adjusted set. Following a more extensive series of studies, adjustments for a wide range of cross-sections were selected. The adjusted set FGL5A was then produced. The values calculated with this set were not identical with the fitted values in the adjustment program, LSQ. This was because of approximations such as the use of first order perturbation theory in LSQ. The only significant difference, however, was an average 0.3% underestimation of k-effective values in plutonium-fueled cores. This was removed by making a further small adjustment to the Pu-239 fission cross-section above about 100 keV. (auth)

7825 DEVELOPMENT OF THE JAERI CALCULATION SYSTEMS FOR FAST REACTORS. Katsuragi, S.; Takano, H.; Hasegawa, A.; Suzuki, T.; Kikuchi, Y. (Japan Atomic Energy Research Inst., Tokai). pp 1117-1132 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Since 1962 the development of fast reactor calculation systems has been extensively carried out by JAERI. The guiding principle is that programs be applicable to nuclear design as well as reactor physics analyses, so that due considerations are paid to accuracies of approximations to be adopted and economies of computer time and labor. The JAERI fast reactor group constants systems were produced by 1970 to suit the above principle. Prior to this, various computer programs had been developed, and elaborate analyses had been made in order to assure better accuracies of the group constants. Many calculation programs for design and analysis were prepared utilizing the constants systems. The JAERI fast set was originally designed to use for homogeneous mixtures without strong resonance scatterers of medium weight. For a heterogeneous medium consisting of plate lattices, investigations have been made so as to extend the applicability of the JAERI fast set. For this purpose, the EXPANDA-75 was prepared based on the integral transport equation and the JAERI fast set with 70 groups. The ultrafine spectrum calculation code SDR and fine spectrum calculation code ESELEM have also been improved. The comparison of results shows that the JAERI fast set, although prepared for homogeneous mixtures, can be used for plate type heterogeneity and gives better results for heterogeneity effects, if appropriate effective admixture cross sections are used. Another drawback in the set was the treatment of elastic removal cross sections in the case of a medium containing a strong resonance scatterer. An investigation was made in order to obtain an analytical representation of the spectrum around the scattering resonance energy. The elastic removal cross sections can be generated quite easily using this spectrum. The parameters needed in this treatment will be included into the JAERI fast set. (auth)

7826 ANALYSIS OF INTEGRAL EXPERIMENTS PERFORMED ON FAST CRITICAL ASSEMBLIES. Doolin, V. A.; Kazanskii, Yu. A.; Mamontov, V. F.; Sidorov, G. I.; Golyaev, N. D. (State Committee for Utilization of Atomic Energy, Obninsk, USSR). pp 464-485 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

An analysis of discrepancies between calculated and experimental results on fast critical assemblies is given. On the basis of this analysis the variations of group constants which decrease the discrepancies are presented. The structure of an error matrix of integral experiment results is discussed. It is shown that this matrix is not diagonal. The components of variances for integral experiment results are investigated. The covariance matrix of results obtained in exponential experiments is presented as an example. (auth)

7827 COMPARISON OF LARGE FAST REACTOR PHYSICS CHARACTERISTICS CALCULATED BY VARIOUS METHODS AND

CONSTANTS. Nikolskii, R. V.; Ziganshin, T. M. (Scientific-Research Inst. for Atomic Reactors, Dimitrovgrad, USSR). pp 1425-1439 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The results of calculations of basic physics characteristics for large fast reactors obtained by various methods and using ABBN-26 and ABBN-26(70) codes are presented. The comparative analysis has been carried out for oxide- and metal-fueled reactors and reactor models. (auth)

7828 EFFECT OF HIGHER PLUTONIUM ISOTOPES AND NEW DELAYED NEUTRON DATA ON FAST REACTOR DYNAMIC CALCULATIONS. Saphier, D.; Yiftah, S. (Soreq Nuclear Research Center, Yavne, Israel). pp 1491-1512 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The effects of newly evaluated nuclear data for the higher plutonium isotopes and improved measurements of delayed neutron data on the kinetic parameters and the transient behavior of fast reactors are discussed. Calculations using ENDF-B/III and Keepin's delayed neutron data were compared with calculations using the new plutonium evaluations and the newly measured delayed neutron data. Comparative analysis of the kinetic parameters and the spatio-temporal behavior of various fast reactor configurations, subject to local perturbations, have been performed, with special emphasis on the following effects: (a) differences in power excursions in reactors using pure ^{239}Pu and varying amounts of ^{240}Pu, ^{241}Pu and ^{242}Pu, (b) comparative dynamic behavior, as in (a), using newly evaluated plutonium data and ENDF-B/III data, and (c) differences in power transients using old and new delayed neutron data. Considerable differences in kinetic parameters are observed in large cores when going from ENDF-B/III to new plutonium data, and from reactors with only Pu-239 enrichment to reactors having higher plutonium isotopes. As a result, the transients in large reactors are different while for small reactors there is no difference, regardless of the data source used. The effect of new D.N. data is identical in all cases—it reduces the power excursion in the delayed critical region. (auth)

7829 ITERATIVE NEUTRON FLUX SYNTHESIS FOR FAST REACTORS. Khromov, V. V.; Apsae, V. A.; Kuzmin, A. M.; Sirotkin, A. M.; Slesarev, I. S. (Moscow Physical-Technical Inst.). pp 1513-1534 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

To solve neutron transport equations in multi-dimensional problems requires a large amount of time and memory in electronic computers. The synthesis methods applied to the above equations are called upon to essentially simplify the calculation of neutron distributions. Iterative synthesis of neutron distribution used in the Soviet Union for an optimization analysis of fast reactors is briefly reviewed. In synthesis procedures the neutron distribution as a function of many variables can be expressed by a relatively small sum of products, each factor of these products being of lower dimensionality than the original neutron flux. The above functions are chosen bearing in mind the peculiarities of a problem in question. (auth)

7830 ASSESSMENT OF FAST-REACTOR GROUP CONSTANTS FOR SOME REACTOR MATERIALS THROUGH MEASUREMENTS AND ANALYSES OF ENERGY- AND SPACE-DISTRIBUTIONS OF FAST NEUTRONS IN TEST ASSEMBLIES. Nishihara, H. (Kyoto Univ.); Kimura, I.; Kobayashi, K. pp 861-882 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Fast neutron spectra in iron, alumina and thoria have been measured by the neutron time-of-flight method using a linear accelerator as a pulsed neutron source. Along with the time-of-flight (TOF) runs, space distributions of neutrons and x-rays were measured by activation of nickel wires and gold foils. The total length of the flight path was 22.1 m. A bank of three ^{6}Li-glass scintillation counters (NE 912 + EMI 9618 R, 12.7 cm diameter) was mainly used for neutron detection. A liquid scintillation counter (NE 213) and a boron-vaseline counter were also used. A new type high-speed multi-channel time-analyzer with wire-memories has been developed for the fast neutron TOF analyses. The space-, energy- and angular-distributions of neutrons in test assemblies were calculated using the multi-group S_n code "DTF-IV," assuming spherically symmetric geometries. This assumption has been verified by the spherical symmetry observed in spatial distributions of neutron flux. The scattering is assumed to be linearly anisotropic (P_1 approximation). The group constants were mostly taken from the JAERI-FAST SET (J-F) and the ABBN SET (ABBN). Group constants for thorium, which are not included in J-F, have been generated from ENDF/B-2 data (J-M). A new set of group constants for iron (J-E) was also used as input to DTF-IV. This set was generated at JAERI using the exact spectrum by the code ESELEM-IV as the weighting spectrum. (auth)

7831 PROPERTIES OF NEUTRON MIGRATION OPERATORS FOR FAST MULTIPLYING ASSEMBLIES. Orechwa, Y.; Dorning, J. (Univ. of Illinois, Urbana). Trans. Amer. Nucl. Soc.; 19: 167-168(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7832 LOCAL TRANSPORT CALCULATIONS FROM GLOBAL DIFFUSION RESIDUALS. Lineberry, M. J.; McFarlane, H. F. (Argonne National Lab., Idaho Falls, ID). Trans. Amer. Nucl. Soc.; 19: 168-169(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7833 PERTURBATION THEORY IN INTEGRO-DIFFERENTIAL AND INTEGRAL TRANSPORT FORMULATIONS. Greenspan, E. (Nuclear Research Center, Beersheba, Israel). Trans. Amer. Nucl. Soc.; 19: 169-170(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7834 ADJOINT AND NEUTRON FLUX APPROXIMATIONS FOR USE IN PERTURBATION THEORY. Steinke, R. (General Atomic Inc., San Diego, CA). Trans. Amer. Nucl. Soc.; 19: 170-171(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7835 APPROXIMATE GENERATION OF COUPLING PARAMETERS FOR MULTIDIMENSIONAL NEUTRON DIFFUSION CALCULATIONS. Burns, T. J.; Dorning, J. J. (Univ. of Illinois, Urbana). Trans. Amer. Nucl. Soc.; 19: 174-175(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7836 PIECEWISE POLYNOMIALS FOR POINT AND SPACE KINETICS WITH VARIABLE REACTIVITY. Hennart, J. P. (Instituto Politecnico Nacional, Mexico City). Trans. Amer. Nucl. Soc.; 19: 179-180(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7837 ANALYTICAL ESTIMATE OF THE ERROR IN CONVENTIONAL POINT-KINETICS REACTIVITY DUE TO SPATIAL EFFECTS. Apostolakis, G. E. (California Inst. of Tech., Pasadena). Trans. Amer. Nucl. Soc.; 19: 375(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7838 REACTIVITY DETERMINATION IN SUBCRITICAL FAST REACTORS BY AN AREA RATIO METHOD. Dorning, G. J. (Univ. of Illinois, Urbana). Trans. Amer. Nucl. Soc.; 19: 375-376(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7839 IMPROVED METHOD OF INTEGRATING THE IODINE-XENON TRANSIENT EQUATIONS. Rydin, R. A.; Meerbaum, M. I. (Univ. of Virginia, Charlottesville). Trans. Amer. Nucl. Soc.; 19: 377-378(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7840 ANALYTICAL FLUX SOLUTION IN SPACE, TIME, AND ENERGY. Kang, S.; Becker, M. (Rensselaer Polytechnic Inst., Troy, NY). Trans. Amer. Nucl. Soc.; 19: 378-379(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7841 EXTENSION OF THE MODIFIED STATIC FLUX-TILT METHOD TO TWO DIMENSIONS. Beckner, W. D.; Rydin, R. A. (Univ. of Virginia, Charlottesville). Trans. Amer. Nucl. Soc.; 19: 379-380(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7842 INCORPORATING DELAYED NEUTRONS INTO REACTOR NOISE THEORY. Wang, H. K.; Ruby, L. (Univ. of California, Berkeley). Trans. Amer. Nucl. Soc.; 19: 380-381(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7843 REVIEW OF INTERNATIONAL NOISE CONFERENCE HELD IN ROME, OCTOBER 1974. Pacilio, N.; Jorio, V. M. (CSN, Rome). Trans. Amer. Nucl. Soc.; 19: 382(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7844 CALCULATIONS OF EFFECTIVE MULTIGROUP CROSS SECTIONS AND NUCLEAR SYSTEMS BY THE ENERGY MOMENTS METHOD. Gur, Y.; Yiftah, S. (Soreq Nuclear Research Center, Yavne, Israel). Trans. Amer. Nucl. Soc.; 19: 391-392(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7845 PROCESSING AND TESTING OF ENDF/B-IV FISSION PRODUCT AND TRANSMUTATION DATA. Kee, C. W. (Oak Ridge National Lab., TN); Weisbin, C. R.; Schenter, R. E. Trans. Amer. Nucl. Soc.; 19: 398-399(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7846 CENTRAL-WORTH C/E RATIOS AND SENSITIVITY COEFFICIENTS FOR DELAYED NEUTRONS. Bohn, E. M. (Argonne National Lab., Ill.). Trans. Amer. Nucl. Soc.; 19: 400-401(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7847 SINGULAR TRIAL FUNCTIONS IN VARIATIONAL PRINCIPLES. Hauss, B.; Kastenberg, W. E. (Univ. of California, Los Angeles). Trans. Amer. Nucl. Soc.; 19: 411-412(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7848 TIME-LETHARGY EQUIVALENCE THEOREM IN NEUTRON TRANSPORT THEORY. Ganapol, B. D. (CEN de Saclay, Gif-sur-Yvette, France); Henninger, R. J.; Peddicord, K. L. Trans. Amer. Nucl. Soc.; 19: 412-413(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7849 SPECTRAL SYNTHESIS FOR LOW-ENRICHMENT SYSTEMS. Gitnick, B. (General Electric Co., San Jose, CA); Becker, M. Trans. Amer. Nucl. Soc.; 19: 413-415(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7850 APPLICATIONS OF SPATIAL FLUX SYNTHESIS TO FAST CRITICAL EXPERIMENT ANALYSIS. Lineberry, M. J. (Argonne National Lab., Idaho Falls, ID); Adams, C. H. Trans. Amer. Nucl. Soc.; 19: 415-416(1974).
From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7851 ON THE NEUTRON IMPORTANCE FUNCTION FOR A HETEROGENEOUS REACTOR. Lobyntsev, V. A.; Nosov, V. I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 24-29(1973). (In Russian).
The formulation and solution of coupling problem for heterogeneous reactors were considered in the multigroup approximation. Special attention is given to the boundary conditions of the coupling problem, which were obtained in the general form. The specific conditions corresponding to the albedo, effective, etc. boundary conditions of the direct problems were examined. In relation to the development of methods, a two-dimensional problem of the calculation of the neutron importance function in cylindrical heterogeneous reactors was solved. The calculation results were reported for heterogeneous active zones of reactors with circular placement of B-containing rods through its cross section; water voids occur in the center of the reactor. (tr-auth)

7852 CALCULATION ALGORITHM OF FAST MULTIZONED MONODIMENSIONAL REACTORS. Pavelescu, M. (Inst. of Atomic Physics, Bucharest). Stud. Cercet. Fiz.; 25: No. 4, 393-402(1973). (In Rumanian).
A multigroup diffusion approximation algorithm for the calculation of fast, multizoned, one-dimensional reactors is proposed. The algorithm yields the critical states when the amount of fertile material and the distribution of fertile and fissile material are known. The initial reproduction and consumption rates are calculated with a multigroup flux distribution normalized at a maximum specific power of 1 watt. The manner in which matrices of the reproduction and consumption rates can be constructed is indicated. These matrices are the separately solvable gain and loss matrices, respectively, of a nonzero sum game. (auth)

7853 SLOWING DOWN DENSITY OF NEUTRONS IN A CYLINDRICAL PILE. Deshpande, V. L. (Pratap Coll., Amalner (India)). Def. Sci. J. (New Delhi); 23: No. 4, 159-161(Oct 1973).
Following Sneddon's solution for the equation governing the slowing down of neutrons in matter for a pile in the form of a rectangular parallelopiped, an attempt has been made to obtain a similar solution for the equation when the pile is in the form of a cylinder of infinite height. This has also been extended for various types of sources. (INIS)

7854 JACOBI POLYNOMIAL APPLICATION FOR THE DESCRIPTION OF THE GAMMA-RAYS DISTRIBUTION. Broder, D. L.; Platovskikh, Yu. A.; Popkov, K. K.; Sergeev, I. V. Vestsi Akad. Navuk Belarus. SSR, Ser. Fiz.-Energ. Navuk; No. 1, 13-18(1973). (In Russian).
The possibility of obtaining an approximation kinetic equation in cylindrical geometry by series expansion of the angular dependence according to Yakov polynomials, containing two arbitrary parameters, was shown. The scattering distribution function and the indicatrix function differed according to the polynomial which can have different values of the parameters. A multigroup system of equations was obtained. It was shown that by use of the Yakov polynomials for the approximate solution of the kinetic equation, described in a modified coordinate system, it was possible to describe satisfactorily the spatial-energy dependence of the radiation current even in the first approximation. (tr-auth)

Reactor Components and Accessories

Refer also to abstracts 5856, 5931, 5932, 6201, 6566, 6673, 7800, 7805, and 7894.

7855 (AED-CONF-73-463-004) TENDENCIES IN THE DEVELOPMENT OF MAIN CIRCULATION WATER PUMPS IN POWER STATIONS. Oertel, R.; Roemer, A. (Maschinenfabrik Augsburg-Nuernberg (M.A.N.) A. G., Gustavsburg (F. R. Germany). Werk Gustavsburg). 1973. 9p. (In German). INIS.
From pump conference; Karlsruhe, F. R. Germany (2 Oct 1973). 4 figs. With abstract in English and German.
The output of power station blocks has risen considerably in the past years. To cope with the greater cooling water requirements resulting from this increase several smaller pumps were used. Economic considerations make it necessary to raise the circulation water pump capacities. The large dimensions required for this purpose lead to new design approaches. Since the most economical version of main circulating water pumps is the tubular casing type, except in a few special cases where the spiral casing pump offers advantages, a concrete casing provides the best answer in large-size applications. A few typical tubular casing pumps are described. (auth)

7856 (ANL-CT-75-08) ADDED MASS AND DAMPING OF A VIBRATING ROD IN CONFINED VISCOUS FLUIDS. Wambsganss, M. W.; Chen, S. S.; Jendrzejczyk, J. A. (Argonne National Lab., Ill. (USA)). Sep 1974. Contract W-31-109-eng-38. 30p. Dep. NTIS $4.00.
An analytical and experimental study of a cylindrical rod vibrating in a viscous fluid enclosed by a rigid, concentric cylindrical shell is presented. A closed form solution for the added mass and damping coefficient is obtained and a series of experiments with cantilevered rods vibrating in various viscous fluids is performed. Experimental data and theoretical results are in good agreement. (auth)

7857 (FRNC-CONF-114) CONSTRUCTION PRINCIPLES AND BASIC PARAMETERS FOR 4-POLE HIGH POWER TURBO-ALTERNATORS. Dureault, M. (Societe Jeumont-Schneider, 75-Paris (France)). [nd]. 17p. (In French). (CONF-730983-16). Dep. NTIS (US Sales Only) $4.00.
From Congress of the Society of Electrical, Electronic and Radio Engineers meeting; Vittel, France (11 Sep 1973).

Certain changes in basic parameters that made it possible to expand greatly the power/volume ratio of 1500 r.p.m. alternators, the influence of the machine's geometry in enabling these changes to be made, and their effect on certain important characteristics are reviewed. The method of construction of the main components (rotor, rotor winding, the magnetic circuit and stator winding), the cooling processes used, and certain measures taken to facilitate transport are described. (auth)

7858 (ORNL-TM-4764) SECOND INTERIM REPORT ON PCRV THERMAL CYLINDER AXIAL TENDON FAILURES. Canonico, D. A. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 42p. NTIS $4.00.

In May, 1973, the PCRV thermal cylinder test was terminated. During detensioning of the axial prestressing tendons it was noted that a number of the inner row tendons had failed during the lifetime of the experiment. An initial investigation showed that the individual wires in the tendons had failed both before and after the hot-spot test. The posttest examination has centered on the cause of these failures. The failures have been attributed to stress-corrosion cracking. Laboratory experiments have shown that the 1080 steel is susceptible to nitrate stress-corrosion cracking. The wax surrounding the failed tendons was found to contain about 2.5% H_2O and high N content. Further there was a strong ammonia odor associated with a newly disassembled tendon duct. There is evidence that the nitrogen is due to excess amine that resulted from the use of incorrectly formulated epoxy resin in the region of the bottom anchor plates. A stress-corrosion mechanism involving $(NH_4)_2CO_3$ has been postulated and tests of stressed wires in this environment are being conducted. There is evidence that wire failures in the outer row are imminent. A critical examination of wires from an outer-row tendon indicated possible cracks. Further, there is an apparent loss of load-carrying ability in an outer-row tendon. This was observed during the reloading of two concrete segments that had been removed from the thermal cylinder model. This study will assess the effect of reversing the original thermal gradient that existed during the test. (auth)

7859 (RDT-F-9-5T(09-74)) GUIDELINES AND PROCEDURES FOR DESIGN OF NUCLEAR SYSTEM COMPONENTS AT ELEVATED TEMPERATURE. (USAEC Division of Reactor Research and Development, Washington, D. C.). 28 Sep 1974. 271p. RSO.

Information is presented concerning the structural evaluation program, flow of design analysis, inelastic analysis methods, verification and qualification of analysis methods, evaluation, and fabrication and environmental effects. (auth)

7860 SOLID-BORNE SOUND MEASURING—A WAY FOR THE OPERATIONAL INSPECTION OF REACTOR PRESSURE VESSELS. Moravek, I.; Raible, B. (Allianz-Zentrum fuer Technik G.m.b.H. (AZT), Ismaning/Muenchen (F. R. Germany). Arbeitsgruppe Messtechnik). Maschinenschaden; 47: No. 1, 30-34(1974). (In German).

9 figs.

Solid-borne sounds on reactor pressure vessels can be subdivided into three frequency ranges. In the low frequency range below 100 Hz it is possible to detect pendulum movement of the core container as well as to control oscillations of other components. In the middle frequency range, the rotational speed-specific spectral part due to pumps can be recognized; in the upper frequency range up to the limiting frequency of the receiver, the rattling and ringing noises of free and loose parts can be determined. The location of loose parts is possible with the help of travel time measurements. The solid-borne sound measuring technique can be used in this case as a diagnosis method. (GE)

7861 INTERACTION BETWEEN MANUFACTURER AND CUSTOMER CONCERNING HEAVY STRUCTURAL COMPONENTS. Zwingenberger, L. (Vereinigte Oesterreichische Eisen- und Stahlwerke A. G. (VOEEST)—Alpine Montan, Linz). Chem.-Ing.-Tech.; 46: No. 13, 542-547(Jul 1974). (In German).

From 199th DECHEMA colloquium; Frankfurt am Main, F. R. Germany (4 Nov 1973). 5 figs.; 1 ref.

The design of heavy structural components of chemical plants and reactors is so strongly determined by the overall procedure that there is little margin left for the manufacturer and suppliers to develop design concepts of their own. Hence close cooperation with experienced experts of the orderer is one of the basic requirements in order to ensure high-quality fabrication. Practice has shown that it is of advantage if manufacturer and orderer of heavy structural components cooperate in the qualitative analysis of the component in order to achieve the optimum. The paper deals with the following items: placing of orders, standardization, specification, design; tolerances, testing and control, technical approval as well as disturbances in the process. (GE)

7862 SEISMIC QUALIFICATION BY A COMPUTER-CONTROLLED TEST SYSTEM. Kao, G. C.; Holbrook, W. W. (Wyle Labs., Huntsville, AL). Trans. Amer. Nucl. Soc.; 19: 32-33(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7863 QUALITY ASSURANCE AND MATERIALS ENGINEERING TECHNOLOGY IN NUCLEAR POWER PLANTS. Thielsch, H. (ITT Grinnell Corp., Providence). Trans. Amer. Nucl. Soc.; 19: 126(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7864 ROLE OF MATERIAL PROPERTIES IN STRESS ANALYSIS OF REACTOR PROBLEMS. Rashid, Y. R. (General Electric Corp., San Jose, CA). Trans. Amer. Nucl. Soc.; 19: 151(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7865 FINITE-ELEMENT ANALYSIS OF STRUCTURAL PROBLEMS. Becker, E. B. (Univ. of Texas, Austin). Trans. Amer. Nucl. Soc.; 19: 151-152(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7866 FINITE-ELEMENT METHODS FOR COUPLED FIELD-STRESS PROBLEMS. Nickell, R. E. (Sandia Labs., Albuquerque, NM). Trans. Amer. Nucl. Soc.; 19: 152-153(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7867 SADCAT: A NONLINEAR TRANSIENT CODE FOR PLATE/SHELL STRUCTURES IN 3-D SPACE. Marchertas, A. H. (Argonne National Lab., IL); Belytschko, T. Trans. Amer. Nucl. Soc.; 19: 159-160(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7868 IMPLEMENTATION OF AN ENERGY SOURCE IN A STRUCTURAL-RESPONSE CODE: STRAW. Kennedy, J. M. (Argonne National Lab., IL); Belytschko, T. Trans. Amer. Nucl. Soc.; 19: 160-161(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7869 UTILIZATION OF REACTOR INSTRUMENTATION DATA: A UTILITY VIEWPOINT. Bond, G. R.; Luoma, J. D. (GPU Service Corp., Parsippany, NJ). Trans. Amer. Nucl. Soc.; 19: 218(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7870 EFFECTS OF CROSS-LINKING ON RELIABILITY OF PLANT PROTECTION SYSTEM. Hansen, A. H. (Westinghouse Electric Corp., Madison, PA); Husseiny, A. A. Trans. Amer. Nucl. Soc.; 19: 235-236(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7871 QUALITY ASSURANCE REQUIREMENTS ASSOCIATED WITH A SPARE PARTS PROGRAM. Ramsett, L. O. (Wisconsin Public Service Corp., Green Bay); Vellender, G. C. Trans. Amer. Nucl. Soc.; 19: 333(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7872 PRACTICAL USE OF FAILURE-MODE EXPERIENCE. Tashjian, B. M. (Combustion Engineering, Inc., Windsor, CT). Trans. Amer. Nucl. Soc.; 19: 343-344(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7873 USE OF AVAILABILITY EXPERIENCE DATA IN RELIABILITY IMPROVEMENT. Shor, S. W. W. (Bechtel Power Corp., San Francisco). Trans. Amer. Nucl. Soc.; 19: 344(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7874 QUALITATIVE ASSESSMENT OF NUCLEAR POWER PLANT COMPONENT RELIABILITY. Kaut, S. W.; Miller, Q. R. (Nuclear Services Corp., Indianapolis). Trans. Amer. Nucl. Soc.; 19: 345(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7875 CALCULATION OF THE PARAMETERS OF THE SHIELDING FACTOR CURVES. Gur, Y.; Yiftah, S. (Soreq Nuclear Research Center, Yavne, Israel). Trans. Amer. Nucl. Soc.; 19: 391(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7876 CORRECTION FOR DETECTION EFFICIENCY CHANGES AND DETECTOR COUNTING LOSS IN A THREE-POINT IKRD REACTIVITY MEASUREMENT. Allen, J. W. (Univ. of Tennessee, Knoxville); Robinson, J. C.; Mihalczo, J. T.; Ackermann, N. J. Jr. Trans. Amer. Nucl. Soc.; 19: 417-418(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7877 PRESSURE VESSELS MADE FROM STRUCTURAL STEEL WITH LIMITED TENSILE STRENGTH BASED ON TECHNOLOGICAL CONDITIONS ESPECIALLY REACTOR PRESSURE VESSELS. Machatti, H. (to Rella, H. und Co., Baugesellschaft, Vienna (Austria)). Austrian Patent 8495/70/A. 18 Sep 1970. 10p. (In German).

Available from Oesterreichisches Patentamt, 1010 Vienna.

A reactor pressure vessel made from structural steel and prestressed in several directions with prestressing elements fabricated of steel with a high yield point is described. This design allows a substantial reduction of wall thickness or an increase of the inner diameter of the pressure vessel assuming constant wall thickness. The prestress of the prestressing elements is designed to achieve the maximum possible stress release of the vessel walls at normal operating conditions and to fully utilize the maximum permissible load of the vessel walls. In order to avoid the hazard of explosion of the pressure vessel the cross section of prestressing elements is dimensioned so that on any kind of loads strain is never reaching 20% of the yield point. (INIS)

Reactor Fuels

Refer also to abstracts 5687, 5703, 5713–5720, 5722, 5725, 5726, 6470–6487, 6500, and 6749.

7878 (ANL/MSD-08) LIFE-III ISOTOPIC GAS-RELEASE MODEL. Rest, J. (Argonne National Lab., Ill. (USA)). Jul 1974. Contract W-31-109-Eng-38. 17p. Dep. NTIS $4.00.

A spherical diffusion model for isotopic gas release from nuclear-reactor fuel elements is incorporated into the LIFE-III multiregion fuel-behavior code. The isotopic gas-release-to-birth ratio predictions of the model are compared with data from two nuclear fuel elements irradiated in different neutron fluxes. Reasonable agreement between model predictions and experiment is demonstrated. An argument is also given wherein the LIFE-III isotopic gas-release model can be used as an aid in locating failed nuclear-reactor fuel elements. (auth)

7879 NUCLEAR FUEL ELEMENT AND A METHOD OF MANUFACTURE THEREOF. Wood, J. C. (to Atomic Energy of Canada Ltd.). Canadian Patent 954,640. 10 Sep 1974.

A nuclear fuel element is described having a sheath of zirconium or a zirconium alloy and a cross-linked siloxane lacquer coating on the inner surface of the sheath and separating the nuclear fuel material from the sheath. The siloxane lacquer coating retards cracking of the sheath by iodine vapor emitted by the fuel during burnup, and acts as a lubricant for the fuel to prevent rupture of the sheath by thermal ratcheting of the fuel against the sheath caused by differential thermal expansion between the fuel and the sheath. A silicone grease is applied as a thin layer in the sheath and then baked so that oxidative cleavage of the side chains of the grease occurs to form a cross-linked siloxane lacquer coating bonded to the sheath. (CA)

7880 STATISTICAL ANALYSIS AND MODELING OF GAP CONDUCTANCE DATA FOR FUEL RODS CONTAINING UO_2 PELLETS. Lanning, D. D.; Hann, C. R.; Gilbert, E. S. (Brookhaven National Lab., Upton, NY). Trans. Amer. Nucl. Soc.; 19: 112-113 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7881 NEW THREE-DIMENSIONAL APPROACH TO FUEL-PIN PERFORMANCE MODELING. Kjaer-Pedersen, N. (Elsinore Shipbuilding and Engineering Co., Roskilde, Denmark). Trans. Amer. Nucl. Soc.; 19: 113(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7882 TRANSVERSE HEAT CONDUCTION IN COMPOSITE ADVANCED REACTOR FUELS. Bush, G. C.; Carlson, R. W. (Georgia Inst. of Tech., Atlanta). Trans. Amer. Nucl. Soc., 19: 124-125(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7883 PARAMETRIC STUDY OF HEAT TRANSFER FROM UO_2 FUEL PELLETS LOCATED ECCENTRICALLY WITHIN THE CLADDING. Goldberg, M. D.; Rust, J. H. (Georgia Inst. of Tech., Atlanta). Trans. Amer. Nucl. Soc.; 19: 318-319(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7884 DECAY HEATING MEASUREMENTS AND CALCULATIONS FOR FOUR IRRADIATED REACTOR FUELS. Gunst, S. B.; Conway, D. E.; Connor, J. C. (Westinghouse Electric Corp., West Mifflin, PA). Trans. Amer. Nucl. Soc.; 19: 406(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7885 CYLINDRICAL FUEL ELEMENTS WITH RED-BLOOD-CELL-SHAPED CROSS SECTION. Ching Tu, C. C. (Univ. of Sao Paulo, Brazil); Hukai, R. Y. Trans. Amer. Nucl. Soc., 19: 416 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Reactor Control Systems

7886 (JUL-1040-RE) INVESTIGATION OF SHUTDOWN CONDITIONS FOR REACTIVITY RAMPS IN THE 23 MW-OPERATION OF THE FRJ-2 (DIDO). Kalker, K. J.; Schierhorn, A. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Zentralabteilung Forschungsreaktoren). Jan 1974. 44p. (In German). Dep. NTIS (US Sales Only) $5.25.

For the operation of the 23 MW FRJ-2 (DIDO) the efficiency of the new control and shutdown system was investigated for the case that arbitrary reactivity ramps initiate power excursions. In all investigations an analog computer was used and the reactor was simulated with 12 groups of delayed neutrons. Film boiling and flow instability was assumed to occur at a power of 1.32 times 23 MW. With these conditions $\Delta K/K$-values below 1.54 were safely controlled. (GE)

7887 MOZART CONTROL ROD EXPERIMENTS AND THEIR INTERPRETATION. Broomfield, A. M. (Atomic Energy Establishment, Winfrith, Eng.); Collins, P. J.; Carter, M. D.; Marshall, J.; Sugawara, A. pp 312-334 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The MONJU mockup assembly at ZEBRA, MZC, provided for a study of the behavior of control rods consisting of 19-pin rod clusters of natural B_4C, enriched (30, 80, 90%) B_4C, and tantalum. The absorbing pins were loaded into sodium-filled calandrias occupying the space of four normal Zebra fuel elements. All the reactivity measurements were made using the critical balance technique, with additional fuel elements at the outer core/blanket boundary being used to compensate the addition of the control rods. Comparison with theoretical prediction is made by comparing the eigenvalues of the clean and rodded loadings. The configurations extended from single rods at the core center and off-center positions to arrays of three and four rods to study interaction effects. Reaction rates within the absorber pins were measured using a variety of detectors to provide a basis for testing the treatment of the rod heterogeneity, while macroscopic scans were made to assist in the diagnosis of errors in predicting interactions. The standard method of calculation of control rod worths is based on the use of XY diffusion theory with the FGL5 data appropriately condensed to 9-groups. The cross-sections for the control rod are obtained using MURAL and a two-region cylindrical model. Calculations made in this way significantly over-predict the rod worths. The results of more sophisticated treatments in which the rod geometry is explicitly represented are included. (auth)

7888 CONTROL ROD MEASUREMENTS IN A URANIUM-FUELED MOCK-UP OF THE FAST BREEDER PROTOTYPE SNR. Helm, F.; Boehme, R.; Durance, G.; Fehsenfeld, P.; Pinter, M. (Kernforschungzentrum, Karlsruhe, Ger.). pp 1033-1057 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

In the fast critical facility SNEAK a two-zoned uranium fueled assembly (SNEAK 9A) was built with approximately the physical characteristics and the dimensions of the SNR-reactor. The main purpose of the investigations is an improvement in the prediction of power distributions and control-rod worths. Enriched uranium was chosen as fuel in order to allow a complete mock-up with the material supply available. Besides this fuel the unit cell of the core contained sodium, sodium carbonate and graphite. The ^{235}U enrichment was 20% in the inner zone (radius 47.5 – 49.9 cm) and 35% in the outer zone (radius 59.2 to 71.1 cm, depending on the insertion of simulated control rods). The core height was 90 cm. According to the design of the SNR, 12 positions for simulating absorber rods, each comprising 4 SNEAK elements, were provided: for safety rods three positions on an inner ring and for compensating rods three positions on an inner ring and 6 on an outer ring just beyond the zone boundary. Absorber parts of the simulated rods were filled with 12 B_4C and 4 aluminium rodlets per SNEAK element. Follower parts contained sodium. The experimental program was designed to comprise three main steps: (1) Assembly 9A0—a clean two-zone core without simulated control rods, (2) Assembly 9A1 with follower material in all twelve compensating and safety rod positions, and (3) Assembly 9A2 which was the main reference assembly of the series with all simulated SNR compensating rods inserted 40 cm and follower material in the SNR safety rod positions. The results of the experiments will aid in determining the optimal ^{10}B content of the SNR absorber rods and in planning the insertion policy during burn-up. (auth)

7889 EFFECT OF ROD REMOVAL ON THE WORTH OF A CONTROL ROD ARRAY IN A LARGE FAST REACTOR. Austin, J. W. (Central Electricity Generating Board, Cheltenham, Eng.). pp 1255-1273 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

During refueling operations performed on a shutdown fast reactor, it may be necessary to remove control rods for maintenance or other reasons, thus reducing the shutdown margin. It is a well-known problem of thermal reactor design that the removal of a small number of control rods from an array can under certain circumstances considerably change the worth of that array. A study has been carried out to determine the extent to which similar problems exist in a large fast power reactor. The reactor layout chosen for study consisted of 192 inner core, 133 outer core, and 210 radial breeder subassemblies on a hexagonal lattice. Three different patterns of boron carbide control rods were examined. The first pattern was a uniform array on a 1 in 9 pitch over the inner and outer core enrichment zones. The second pattern was a similar uniform array but confined to the inner enrichment zone. The third pattern consisted of two hexagonal rings of rods, one ring in each zone. Diffusion theory calculations were performed in hexagonal geometry, for which condensing spectra were obtained from 35 energy groups, one-dimensional calculations. The boron content of the rods was adjusted for each pattern until the worths of the patterns were approximately equal at a value of about 7% dk/k. Calculations were then carried out with up to three rods missing from each pattern and the reduction in worth determined. (auth)

7890 CONTROL ROD OPTIMIZATION FOR THE SNR-300. Billaux, M.; de Wouters, R.; Hoenraet, C.; Pilate, S.; Vandenberg, C. (Societe Belge pour l'Industrie Nucleaire, Brussels). pp 1241-1254 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

The physics problems associated with the control rod system of the German–Belgian–Dutch 300 MW(e) prototype fast reactor SNR-300 are discussed, with emphasis on the theoretical optimization of the control rod pattern and control strategy. (auth)

7891 CALCULATION OF FAST REACTORS CONTROL ROD EFFICIENCY. Gorbatov, N. E.; Ivanov, A. P.; Matveev, V. I. (State Committee for Utilization of Atomic Energy, Obninsk, USSR). pp 1274-1284 of Proceedings of the International Symposium on Physics of Fast Reactors. Tokyo; Power Reactor and Nuclear Fuel Development Corp. (1973).

From international symposium on physics of fast reactors; Tokyo, Japan (16 Oct 1973).

Approximate methods of control rod efficiency calculation used in designing the BN-350 and BN-600 reactors are considered. The calculation results in multigroup and few-group diffusion approximations are presented. The calculation results are compared with the experimental values obtained on the BFS-facility and at the physical start-up of BN-350. The comparison shows the applicability of simplified methods for control rod efficiency calculation within the accuracy of 10%. (auth)

7892 NOVEL SOLUTION METHOD FOR OPTIMAL CONTROL OF NUCLEAR SYSTEMS. Naser, J. A.; Chambre, P. L. (Univ. of California, Berkeley). Trans. Amer. Nucl. Soc.; 19: 175-177 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7893 OBSERVER FOR SPATIAL XENON OSCILLATION CONTROL. Pack, R. W.; Chambre, P. L. (Univ. of California, Berkeley). Trans. Amer. Nucl. Soc.; 19: 177-178(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7894 IN-CORE FISSION CHAMBERS FOR FUEL MANAGEMENT AND REACTOR CONTROL. Fuller, E.; Philips, A. L.; Parkos, G. R. (General Electric Co., San Jose, CA). Trans. Amer. Nucl. Soc.; 19: 220(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7895 SCRAM DYNAMICS OF A CONTROL ROD WITH HYDRAULIC SCRAM ASSIST. Lipps, A. J. (General Electric Co., Sunnyvale, CA). Trans. Amer. Nucl. Soc.; 19: 275-276(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7896 EUROPIUM-OXIDE ABSORBER ASSEMBLY DESIGN: FEASIBILITY AND DESIGN OPTIONS. Gluekler, E. L. (General Electric Co., Sunnyvale, CA). Trans. Amer. Nucl. Soc.; 19: 305(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7897 DESIGN OF A PARTIAL SHUTDOWN SYSTEM (PSS). Hansen, A. H. (Westinghouse Electric Corp., Madison, PA); Husseiny, A. A. Trans. Amer. Nucl. Soc.; 19: 334(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7898 INTEGRAL TRANSPORT CALCULATION OF SPATIAL GADOLINIUM DEPLETION. Leonard, A. (National Aeronautics and Space Administration, Moffett Field, CA); McDaniel, C. T.; Petrick, W. P. Trans. Amer. Nucl. Soc.; 19: 406-407(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7899 EVALUATION OF CONTROL SYSTEM HETEROGENEITIES IN AN LMFBR. Hitchcock, J. T.; Hartman, A. K. (General Electric Co., Sunnyvale, CA). Trans. Amer. Nucl. Soc.; 19: 409-410(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7900 HETEROGENEITY EFFECT ON CONTROL-ROD WORTH CALCULATION IN LMFBR. Kato, Y.; Takeda, S. (Hitachi Ltd., Ibaraki-ken, Japan). Trans. Amer. Nucl. Soc.; 19: 410-411(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7901 POWER PLANT CONTROLS: DISPLAYS, COMPUTERS, AND MAN. Kaplan, G. IEEE Spectrum; 11: No. 11, 78-82(Nov 1974).

Improvements in safety and reliability of nuclear power plants through new concepts in the design of instrumentation and controls are discussed. Included are the application of human-engineering concepts to control-panel design, the selection of data display systems, and increased use of computers. (DG)

Nuclear Power Plant Economics

Refer also to abstract 6544.

7902 (AED-CONF-74-116-003) STATE AND PROGRESS OF MULTI-PURPOSE EXPLOITATION OF NUCLEAR POWER REACTORS. Hatle, Z. (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1974. 12p. INIS.

From VGB conference on 'research in power plant engineering'; Essen F. R. Germany (26 Mar 1974).

10 refs. With abstract. Available from ZAED.

Multi-purpose nuclear reactors have acquired technical and economic advantages in comparison with electricity generation only by means of condensation. Exploitation of the waste heat, considering the approaching lack of fuel and energy, has gained more interest. High-temperature reactors are rather advantageous because of the cooling parameters suitable for the steel industry. The paper deals with designs of nuclear sources used for heat supply of great cities and for electricity and steam supplied to the industrial areas as well. Light-water reactors have been the basis for these considerations; in the CSSR there is the VVER/PWR/ unit of 440 MW(e). The situation in the CSSR is described in detail. The perspective exploitation of the high-temperature reactors is mentioned. The conclusion supports the development in this field. (auth)

7903 (EUR-5011d,e,f,i,n) SECOND ILLUSTRATIVE NUCLEAR PROGRAMME FOR THE COMMUNITY. (Commission of the European Communities, Brussels (Belgium)). 1 Jul 1972. 300p. Dep. NTIS (US Sales Only) $18.00. EUR 200.- BF.

Part One contains sections on nuclear energy in the community energy content, nuclear energy and electricity production, objectives of the program, reactor families, potential market and investment requirements, and conditions required for achievement of the program. Part Two (long-term prospects) contains sections on prospects for nuclear energy, new resources available, and breakdown of the market by reactor types. Detailed annexes are included on radiation protection activities in the community, structure of electricity production, light water reactors, the fuel cycle, fast breeder reactors, and high temperature reactors. (JWR)

7904 COMPETITION AMONG ELECTRICAL ENERGY SUPPLY SECTORS IN THE UNITED STATES ENERGY MARKET: TO THE END OF THE CENTURY. Daley, G. C.; Golay, M. W.; Baughman, M. L. (Massachusetts Inst. of Tech., Cambridge). Trans. Amer. Nucl. Soc.; 19: 221-222(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7905 MANPOWER PROBLEMS ASSOCIATED WITH NUCLEAR POWER REACTORS: DIMENSIONS OF THE PROBLEM. Chewning, J. S.; Barker, L. L. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 298(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7906 COMPARISON OF USA CONSTRUCTION COSTS: WHY SO DIFFERENT? Palmeter, S. B. (GPU Service Corp., Parsippany, NJ). Trans. Amer. Nucl. Soc.; 19: 340(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7907 DUPLICATE REACTOR CONSTRUCTION. Campbell, P. G. (Ontario Hydroelectric Power Corp., Toronto). Trans. Amer. Nucl. Soc.; 19: 341-342(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7908 REACTOR CONSTRUCTION MANAGEMENT CAN SOLVE THE PROBLEM. Peters, J. D. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 342 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7909 NUCLEAR PLANT AVAILABILITY. Morris, P. A. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 345(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7910 QUESTIONS AFFECTING PLUTONIUM UTILIZATION IN THERMAL POWER REACTORS. Zolotar, B.; Gelhaus, F. (Electrical Power Research Inst., Palo Alto, CA). Trans. Amer. Nucl. Soc.; 19: 348-349(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7911 COSTS AND BENEFITS OF DYNAMIC TESTING IN POWER REACTORS. Kerlin, T. W. (Univ. of Tennessee, Knoxville). Trans. Amer. Nucl. Soc.; 19: 382-383(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7912 BASIC SCIENTIFIC AND ENGINEERING PROBLEMS IN MEETING FUTURE DEMAND FOR THERMALLY GENERATED ELECTRIC POWER IN THE USSR. Styrikovich, M. A.; Popyrin, L. S. Heat Transfer-Sov. Res.; 6: No. 3, 1-11(1974).

An analysis is presented of the conditions for future development of thermoelectric power stations. The principal trends of further refinement of this type of power plants and the scientific problems involved in their operation and development are examined. (auth)

7913 ATOMNAYA ENERGETIKA ZARUBEZHNYKH STRAN: SCHA, KANADA, VELIKOBRITANIYA, FRANTSIYA, FRG, ITALIYA, SHVETSIYA, SHVEITSARIYA, YAPONIYA. (Atomic Energy Abroad: USA, Canada, Great Britain, France, Federal Republic of Germany, Italy, Switzerland, Sweden, Japan). Petros'yants, A. M. Moscow; Atomizdat (1974). 256p.

The current status of atomic energy in various capitalistic countries is analyzed, and the rate of development of atomic energy along with its growth in competition with the usual energy sources is considered. Existing nuclear power installations and those under construction are considered along with work carried out by the leading scientific centers abroad, mining of uranium ores, the state of work on uranium enrichment, production of heat-releasing elements, and atomic energy development plans. Factual material is collected and is supplemented with impressions of scientists who have visited scientific centers and electric stations abroad. The book is designed for a wide variety of specialists engaged in carrying out atomic energy development programs in the USSR. (tr-auth)

Reactor Fuel Cycle Economics

Refer also to abstracts 5721, 6213, 7513, and 7539.

7914 (AECL-4845) ENERGY FOR FIVE THOUSAND YEARS. Mooradian, A. J. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1974. 8p. (CONF-740237-1). Dep. NTIS (US Sales Only) $4.00. AECL $0.20.

From annual convention of the Canadian Society of Exploration Geophysicists; Calgary, Canada (19 Feb 1974).

Currently known uranium resources burned in the reactors used today will last till the end of the century. New reactor fuel cycles will increase resource utilization and additional resources will be developed as fuel costs rise. It is shown that nuclear-fission fuel resources are sufficient to supply a highly developed world with energy for many thousands of years. The advent of nuclear fusion will double the energy resources again. (auth)

7915 FUEL MANAGEMENT ANALOG FOR TEACHING IN-CORE FUEL MANAGEMENT. Carlson, R. W.; Bush, G. G. (Georgia Inst. of Tech., Atlanta). Trans. Amer. Nucl. Soc., 19: 26-27(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7916 STATISTICAL ANALYSIS OF POTENTIAL BENEFITS OF SEPARATIVE WORK POOLING. Walters, D. H.; Swanson, T. W. (Tennessee Valley Authority, Chattanooga). Trans. Amer. Nucl. Soc.; 19: 222-223(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7917 OPTIMIZATION OF POISON MANAGEMENT BY DYNAMIC PROGRAMMING. Nair, R. K.; Filho, P. P. (Instituto Militar de Engenharia, Rio, Brazil). Trans. Amer. Nucl. Soc.; 19: 224-225(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7918 PLUTONIUM RECYCLE: SOME IMPORTANT REGULATORY ASPECTS. Smiley, S. H. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 346(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7919 INCENTIVES FOR PLUTONIUM RECYCLE IN LWRs. Deonigi, D. E. (Battelle-Northwest Labs., Richland, WA). Trans. Amer. Nucl. Soc.; 19: 347(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

Reactor Licensing and Regulation

Refer also to abstracts 7490-7492, 7748, 7799, and 7918.

7920 (CONF-740472-) LEGAL, POLICY AND LEGISLATIVE CONSIDERATIONS IN REACTOR LICENSING. AIF Seminar, Detroit, Michigan, April 16–19, 1974. Program Report. Price, H. S. (ed.). (Atomic Industrial Forum, Inc., New York (USA)). Sep 1974. 56p. Atomic Industrial Forum, 475 Park Avenue South, New York, N. Y. $10.00.

Presentations from sessions on industry and regulatory perspectives on licensing issues, antitrust, licensing problems beyond AEC alone, legislation, and federal energy regulation are included. (JWR)

7921 (DOCKET-50003-414) INDIAN POINT STATION, UNITS 1 AND 2. Semiannual Operations Report No. 23, January–June 1974. (Consolidated Edison Co. of New York, Inc., New York (USA)). 1974. 292p. (DOCKET-50247-364). Dep. NTIS $17.75.

Operations are summarized including power generation, fuel performance, shutdowns, surveillance tests, and inspections. Data are presented concerning maintenance, radioactive effluent releases, occupational personnel radiation protection, primary coolant chemistry, changes, tests, experiments and environmental monitoring. (FS)

7922 (FIND-50463) FIND: FULTON GENERATING STATION, UNITS 1 AND 2. Hendricks, P. L. (ed.). (USAEC Technical Information Center, Oak Ridge, Tenn.). Nov 1974. 31p. Dep. NTIS $4.00.

An index is presented for the docket report material submitted in conjunction with the application for a nuclear power plant construction permit and operating license. The index citations are to the beginnings of major headings, sections, responses, etc., and refer to grid coordinates on microfiche sheets prepared for each docket report. (DG)

7923 (NP-20216) SAFETY CRITERIA FOR NUCLEAR POWER PLANTS. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)). 25 Jun 1974. 22p. (In German). Dep. NTIS (US Sales Only) $4.25.

Safety standards prepared especially for water-cooled reactors are presented. Included are specifications on quality assurance, fission product release, radiation protection, plant protection against external influences, reactor safety, site selection, and reactor decommissioning. (DG)

7924 (RAI-74-10) REGULATORY ADJUDICATION ISSUANCES AND ISSUANCES OF THE BOARD OF CONTRACT APPEALS, OCTOBER 1974. (USAEC Technical Information Center, Oak Ridge, Tenn.). Nov 1974. 191p. TIC $2.80.

Issuances received from the U. S. Atomic Energy Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented. (DG)

7925 (RAI-74-INDEX-1) INDEXES TO REGULATORY ADJUDICATION ISSUANCES AND ISSUANCES OF THE BOARD OF CONTRACT APPEALS, JANUARY–JUNE 1974. (USAEC Technical Information Center, Oak Ridge, Tenn.). Nov 1974. 136p. TIC $5.45.

Issuances received from the U. S. Atomic Energy Commission, the Atomic Safety and Licensing Appeal Boards, and the Atomic Safety and Licensing Boards are presented. (DG)

7926 (REG/G-1.70.3(Rev.1)(11-74)) RADIATION PROTECTION: ADDITIONAL INFORMATION. (USAEC Directorate of Regulatory Standards, Washington, D.C.). Nov 1974. 8p. DRS Free.

Specifications for the submission of additional information on radiation protection for inclusion in Safety Analysis Reports are presented. (JWR)

7927 (REG/G-1.70.9(11-74)) DESIGN OF SEISMIC CATEGORY I STRUCTURES: ADDITIONAL INFORMATION. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Nov 1974. 18p. DRS Free.

Specifications are presented for the submission of additional information on the design of seismic category I structures for inclusion in Safety Analysis Reports. (JWR)

7928 (REG/G-1.70.10(11-74)) ADDITIONAL INFORMATION WIND AND TORNADO LOADINGS. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Nov 1974. 3p. DRS Free.

Supplementary information required in the nuclear power plant safety analysis report which describes methods used to analyze wind and tornado effects on plant structures and components is identified. (DG)

7929 BOTTLENECK LICENSING PROCEDURE. Also a Contribution Presented at the 5th Anniversary of the BASF Application on May 7, 1974. Roser, T. At. Inform.; 74: No. 5, 314(Jun 1974). (In German).

The licensing procedure for nuclear power plants is examined. Improvement recommendations which have been made by various bodies in the FRG are presented. (GE)

7930 THE LICENSING OF NUCLEAR POWER PLANTS. KWU-Rep.; 28: No. 16, 1-6(Jul 1974). (In German).

5 figs.

The article deals with the structure, practice and need of improvement of the licensing of nuclear power plants as seen by the constructor of such plants. (GE)

7931 ACHIEVING A BALANCE BETWEEN THE DEMANDS OF THE REGULATORY PROCESS AND THE DESIGN/CONSTRUCTION PROCESS. Brush, H. F. (Bechtel Power Corp., San Francisco). Trans. Amer. Nucl. Soc.; 19: 299-300(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7932 NUCLEAR POWER PLANT QUALITY ASSURANCE RECORDS. Surgen, O. R.; Martin, R. E. (Information and Business Systems, Inc., West Hyattsville, MD). Trans. Amer. Nucl. Soc.; 19: 328-329(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7933 ANS-19 STANDARDS FOR PHYSICS OF REACTOR DESIGN: ACTIVITIES AND EXPERIENCE INSIGHTS. Greebler, P. (General Electric Co., Sunnyvale, CA). Trans. Amer. Nucl. Soc.; 19: 387(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7934 WHY STANDARDS ON REACTOR PHYSICS ARE REQUIRED? Fieno, D. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 388(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7935 INDUSTRY STANDARDS ON REACTOR PHYSICS: BOON OR BOONDOGGLE. Davey, W. G. (Argonne National Lab., Idaho Falls, ID). Trans. Amer. Nucl. Soc.; 19: 388-389 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7936 BASIC REQUIREMENTS FOR STANDARDS ON REACTOR PHYSICS. Karam, R. A. (General Atomic Inc., San Diego, CA). Trans. Amer. Nucl. Soc.; 19: 389(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7937 NUCLEAR STANDARDS DEVELOPMENT SYSTEM. Chalker, R. G. (Atomics International, Canoga Park, CA). Trans. Amer. Nucl. Soc.; 19: 436-437(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7938 EVOLUTION OF A STANDARD. Savolainen, A. W. (American National Standards Inst., New York). Trans. Amer. Nucl. Soc.; 19: 437(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7939 STANDARDS IN ACTION: THE ROLE OF MEASUREMENT ASSURANCE. Bartlett, J. W. (National Bureau of Standards, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 437-438 (1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7940 NUCLEAR STANDARDS: PLANT DESIGNERS' VIEWPOINT. Bernsen, S. A. (Bechtel Power Corp., San Francisco). Trans. Amer. Nucl. Soc.; 19: 438(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7941 PROGRESS ON NUCLEAR STANDARDS: A UTILITY PERSPECTIVE. Davidson, R. H. (Tennessee Valley Authority, Chattanooga). Trans. Amer. Nucl. Soc.; 19: 439(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7942 NUCLEAR STANDARDS PICTURE: WITHOUT A GOAL THERE IS NO TOUCHDOWN. Gangloff, W. C. (Westinghouse Electric Corp., Pittsburgh). Trans. Amer. Nucl. Soc.; 19: 439-440(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

GENERAL AND MISCELLANEOUS

Civilian Defense

7943 (BNL-19213, pp 20-27) DEFENSE CIVIL PREPAREDNESS AGENCY (DCPA) RESOURCE UTILIZATION AND DEVELOPMENT. Greenhouse, N. A.; Williams, R. D.; Chester, J. D.; Phillips, L. F.; Meinhold, C. B.; Hull, A. P.; Baum, J. W. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

Studies were initiated for the Defense Civil Preparedness Agency (DCPA) to define basic DCPA radiation monitoring requirements and manpower requirements in the event of a peacetime nuclear incident, and to determine how these needs might be met. It was decided that the initial efforts would be directed toward the development of radiological defense resources to cope with nuclear power reactor accidents, since a reactor accident, however remote a possibility, was judged to be more serious than other types of accidents (i.e., transportation accidents). An ac-powered alarm module was designed for use with a Civil Defense instrument, the CDV-700, modified with an end-window G-M tube (CDV-700M). The device can be set to alarm at any exposure-rate up to 50 mR/hr. In the event of a power failure, the alarm circuit becomes inoperative, but the ratemeter will continue to operate for about 30 hours on a set of enclosed, fully charged batteries. The feasibility of using high density gases at high pressures in the CDV-715 ion chamber to increase instrument sensitivity was also studied. (CH)

7944 (ORNL-4979, pp 83-100) STRATEGIC DEFENSE: EXPEDIENT SHELTERS. Chester, C. V.; Cristy, G. A.; Kearny, C. H.; Thurmer, R. N. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Shelters that can be constructed by average citizens in less than 48 hr using their own resources of labor, tools, and materials were designed and field tested. The eventual wide availability of information on these shelter designs will have the potential to significantly alter the outcome of a nuclear war. The very high protection factor of these shelters, over 500 for most below-grade versions, will permit not only survival, but freedom from even symptoms of radiation exposure in the most intense fallout fields likely to be encountered. Most below-grade versions provide very significant protection against blast. The log-covered trench has survived 13 psi and the small-pole shelter has survived 29 psi from a 500-ton TNT explosion. Repeated field experiments have demonstrated the ability of ordinary civilian families to construct these shelters by using only written instructions and available tools and materials. (CH)

Energy Utilization and Economics

7945 (ANL/ES-CEN-1006) REDUCTION OF ATMOSPHERIC POLLUTION BY THE APPLICATION OF FLUIDIZED-BED COMBUSTION. Annual Report, July 1972–June 1973. Vogel, G. J.; Haas, M.; Swift, W.; Riha, J.; Schoffstoll, C. B.; Hepperly, J.; Jonke, A. A. (Argonne National Lab., Ill. (USA)). Jun 1974. Contract W-31-109-eng-38. 132p. (EPA-650/2-74-057). Dep. NTIS $5.45.

The Argonne National Laboratory (ANL) program for demonstrating the feasibility of fluidized-bed combustion for possible use in power and steam plant applications is divided into three studies: (1) combustion of fossil fuels in a pressurized combustor, (2) regeneration of sulfated additive for reuse in the combustor, and (3) evaluation of the type and level of trace-element pollutants in the flue gas. A fluidized-bed combustion pilot plant and a fluidized-bed regenerator, both capable of operating at 10-atm pressure, were tested and operated. In combustion of coal at 9-atm pressure and 1550°F (843°C), high (>90%) retention of sulfur in the fluidized bed of dolomite has been obtained with continuous addition of fresh dolomite at a Ca/S ratio of 3. The NO level in the flue gas is low, <150 ppm. Two favored methods for regenerating the sulfated dolomite were studied: a one-step reductive decomposition of the $CaSO_4$ to CaO at ~1950°F to release SO_2, and a two-step process consisting of reduction of $CaSO_4$ to CaS at ~1700°F followed by reaction of CaS with H_2O/CO_2 to release H_2S. In results to date, complete release of sulfur from the particles were not achieved by either regeneration method, and decrepitation of the particles has been observed. Equipment was constructed and analytical methods were selected for determining the quantity and concentration of trace element pollutants in solid or gaseous form in the flue gas. (auth)

7946 (BNL-14804-R) METAL HYDRIDES AS A SOURCE OF HYDROGEN FUEL. Reilly, J. J.; Wiswall, R. H. Jr.; Hoffman, K. C. (Brookhaven National Lab., Upton, N. Y. (USA)). 1970. 19p. (CONF-700911-4). Dep. NTIS $4.00.

From 160th national meeting of the American Chemical Society; Chicago, Illinois, USA (14 Sep 1970).

The use of hydrogen as a non-polluting fuel is desirable but the difficulties involved in using the cryogenic or compressed form are formidable. However, it appears that certain reversible metal hydrides can be used as a convenient, cheap and safe source of hydrogen fuel. The heat of dissociation can be supplied by the waste heat of the energy converter or, in certain cases, from the surrounding environment. When the hydride is exhausted it may be regenerated by supplying hydrogen at a pressure above its dissociation pressure. Metal hydrides of particular interest are VH_2, Mg_2NiH_4, and MgH_2. Vanadium dihydride contains ~2 wt.% available hydrogen and at 25°C has a dissociation pressure ranging from 2 to 5 atm., depending on its purity. Magnesium nickel hydride and magnesium hydride contain 3.6 wt.% and >7 wt.% hydrogen but both require higher decomposition temperatures. For Mg_2NiH_4 the dissociation pressure at 275°C is 1.9 atm. and for MgH_2 the dissociation pressure at 300°C is 1.8 atm. These systems appear to be ideal for use as a hydrogen source for fuel cell power systems. They could also be used to supply hydrogen to modified internal combustion engines, gas turbines, etc. (auth)

7947 (BNL-18920) HYDROGEN STORAGE AND PRODUCTION IN UTILITY SYSTEMS. Second Quarterly Progress Report, January 1–March 31, 1974. Salzano, F. J. (Ed.). (Brookhaven National Lab., Upton, N. Y. (USA)). Apr 1974. 50p. Dep. NTIS $5.50.

Work was initiated on the development of break even capital costs for electric storage devices based on the energy modeling work and a preliminary estimate of $274/kW (75% efficient) was obtained, based on a projection of present practice and cost trends to 1985. The hydrogen reservoir built for PSE&G of New Jersey was completed, tested, and shipped. Two safety reservoir rupture tests were completed and indicated that iron–titanium hydride appears to present no acute hazards in an extreme rupture accident condition even when fully hydrided. (LK)

7948 (BNL-19267) HYDROGEN ECONOMY: A UTILITY PERSPECTIVE. Lotker, M.; Fein, E.; Salzano, F. J. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 9p. (CONF-740108-2). Dep. NTIS $4.00.

From winter power meeting; New York, New York, USA (27 Jan 1974).

Presented is an overview of the "Hydrogen Economy," a concept in which sources of primary energy such as coal, uranium, deuterium, and sunlight, are used to make hydrogen, which serves as a synthetic fuel in many sectors of the energy consuming market. Specific techniques for the production, transmission, storage, and utilization of hydrogen are described. The impact on the entire energy economy in general and the utility industry specifically is discussed. (auth)

7949 (CONF-740805-7) DEVELOPMENT OF LITHIUM/SULFUR CELLS FOR APPLICATION TO ELECTRIC AUTOMOBILES. Gay, E. C.; Schert, W. W.; Martino, F. J.; Anderson, K. E. (Argonne National Lab., Ill. (USA)). 1974. 26p. Dep. NTIS $4.50.

From 9th intersociety energy conversion engineering conference; San Francisco, California, USA (26 Aug 1974).

The current development efforts on cells of the type Li/LiCl–KCl/FeS_2 are reported, where negative electrodes containing liquid lithium alloys or solid lithium–aluminum alloys and positive electrodes containing iron sulfide, electrolyte, and current collector were investigated. Lithium sulfide was added to some sulfur electrode mixtures for improved cell performance. The operating temperature of most of these cells has been between 385 to 410°C. Electrodes were developed which meet the capacity density requirements for cells of the bicell configuration in a battery for electric automobile propulsion. A high percentage of the theoretical capacity density, 90.5% (based on the FeS_2 added to the positive electrode and a final product of Li_2S), was measured in these cells with solid LiAl electrodes. This percent of theoretical capacity density corresponded to 0.70 A-h/cm^2 at a discharge current density of 0.05 A/cm^2. A short-time peak power density of up to 1.4 W/cm^2 has been measured for liquid lithium electrodes with a charge cutoff voltage of 2.4 V IR-included, which is well within the goal of 1 to 3 W/cm^2. Also, a power density greater than 0.6 W/cm^2 was sustained for up to 55 sec. An operating lifetime of

over 2000 h and a cycle life of over 200 cycles were measured for one of the cells discussed. Reproducible capacity density and a high percentage of the theoretical capacity density were measured over this operating period. These results show that significant progress has been made in the development of cells to meet power density and capacity density requirements for an electric automobile battery. (auth)

7950 (SAND-74-0037) MATERIALS TECHNOLOGY STUDY. Murfin, W. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1974. Contract AT(29-1)-789. 26p. Dep. NTIS $4.50.

The effects on material resources of substitution technology are studied using a detailed material model. It is shown that the existence of such a technology could secure a high standard of living throughout the next century, but the problems of overpopulation and pollution require close attention. (auth)

7951 (SAND-74-0125) FUEL CELLS: DIRECT CONVERSION OF ELECTROCHEMICAL ENERGY INTO ELECTRICITY. Johnson, R. T. Jr. (Sandia Labs., Albuquerque, N. Mex. (USA)). Aug 1974. Contract AT(29-1)-789. 49p. Dep. NTIS $5.50.

Fuel cells convert electrochemical energy directly into electrical power and have higher conversion efficiencies than most methods of electrical generation, especially for low-power systems (25 kW to 10 MW). As energy conversion and energy storage devices, they are quiet, non-polluting, and have the potential of being reliable and maintenance free. The highly-developed hydrogen-oxygen fuel cell provides electrical power for spacecraft. Applications in communication systems, residential and commercial utilities (generation of electricity from natural gas), vehicular transportation, and dispersed large-scale power generation and distribution systems are described. The operation and various types of fuel cells and fuels, the principal advantages and problems, and potential applications are outlined for the benefit of New Mexico. Fuel cells should be considered for electrical power for small communities, for remote sites, for providing utilities for individual residences, and for commercial buildings and industrial sites. Such systems should also be considered for power distribution network and as energy storage devices for handling peak power loads and for generating electrical energy from coal gasification plants and from wastes. (MCW)

7952 (SAND-74-0241) EFFECT OF OUTDOOR AGING ON ACRYLIC SHEET. Rainhart, L. G.; Schimmel, W. P. Jr. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1974. Contract AT(29-1)-789. 41p. (CONF-740811-5). Dep. NTIS $5.25.

From meeting of the international solar energy society; Fort Collins, Colorado, USA (19 Aut 1974).

One of the prime contenders for solar reflectors or concentrators is acrylic plastic. Other than the basic requirement of being a highly efficient reflector or transmitter of the solar spectrum, it must offer excellent long-term weatherability with minimum cost. The weatherability of acrylic polymers, although known to be good compared to other polymers, has been an unknown with regard to actual exposure data in the southwestern United States where the potential is high for solar energy installations. This report is a compilation of data obtained from an acrylic panel that has been exposed for over 17 years in the semi-arid desert terrain south of Albuquerque, New Mexico. A comparison is made with unexposed material having a very similar polymer structure. In general, chemical changes are not detectable while mechanical response shows some evidence of embrittlement. In spite of these, the decrease in optical transmission is surprisingly low. The as-recovered material (with dust eroded surface) had an integrated or total transmittance which was 10% less than the control material, based on a solar radiation spectrum. In order to isolate the degradation loss due to change in the basic polymer, a polished specimen of aged material was tested and showed only a three percent drop in transmission across the solar spectrum. It appears reasonable that this low loss could be duplicated in a solar reflector provided the mirror is coated with an abrasion resistant glass resin system. (auth)

7953 (TID-3351) SOLAR ENERGY. A Bibliography. (USAEC Technical Information Center, Oak Ridge, Tenn.). Dec 1974. 360p. Dep. NTIS $10.60.

References are arranged in broad subject categories. Within a given category the arrangement is chronological. The references are made up of complete bibliographic citations. These are followed by a listing of the subject descriptors used to describe each reference for machine storage and retrieval. Three indexes are provided: Personal Author, Subject, and Report Number. (WDM)

7954 (TID-26637) COAL STRUCTURE AND REACTIVITY. Tingey, G. L.; Morrey, J. R. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Dec 1973. 85p. Dep. NTIS $7.25.

A selective review of the literature was made to determine those areas of research in coal chemistry that need augmentation. It was found that a more thorough basic understanding of coal structure and reactivity will be essential in the further utilization of coal. The petrographic classification of coal is outlined. Ultrafine structures in coal are important from a chemical point of view, as they determine surface areas that are important in heterogeneous reactions. The chemical structure of coal is discussed in terms of its important functional groups. Physical and chemical methods of structural analysis are discussed, and the view is stated that all of these methods need improvement. A review of trace elements in coal is presented. The volatilization, hydrogenation, and solvent extraction of coal are also reviewed. (SFL)

7955 (UCID-16593) FRACTURE-INDUCED PERMEABILITY: PRESENT SITUATION AND PROSPECTS FOR COAL. Stephens, D. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Sep 1974. Contract W-7405-eng-48. 23p. Dep. NTIS $4.25.

Creation of permeability by explosive fracturing is considered. Experimental or inferred in situ permeabilities from nuclear explosive events fall into two groups: very low (≤0.3 md) permeability creation in the events in sandstone and much higher (5 md to 1 d) permeability enhancement in naturally fractured media (granodiorite, dolomite, and granite). Permeability data correlate well with R/R_c, where R_c is the cavity radius, or with failure shear strain (ϵ_f). Simultaneous detonations are quantitatively predicted to produce much flatter permeability distributions than for single or sequential detonation. The projected permeability distribution for HE fracturing by chemical explosive emplaced in an array of drilled holes has serious consequences for the LLL in situ coal gasification concept. Permeabilities are expected to vary by a factor of 50 over 4 R_c, even for simultaneous detonations. Bypassing of at least some coal appears likely. Experimental data for k vs R/R_c or ϵ_f are vitally needed to determine the permeability variations with range. The coal outcrop experiments are expected to be definitive in this regard. Realistic gasification calculations are needed to indicate whether the predicted permeability distributions are acceptable for our concept or whether modifications or alternate solutions must be found. (auth)

7956 SCIENCE, TECHNOLOGY, AND THE ECONOMY. Hearings Before the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U. S. House of Representatives, Ninety-Third Congress, Second Session, February 19, 20, 21, 1974. Washington, DC; Committee on Science and Astronautics (1974). 98p. GPO.

With references to the present energy crisis, hearings were conducted to find out what history teaches about similar crises in the past with references to the effects of the countries of Western Europe during the wood shortage in the 16th century and how society adapted to the new technological solutions. The hearings examined the capability of American science and technology to meet the tasks emanating from the energy crisis and whether American society is ready for a massive injection of new science and technology that is bound to affect the environment and quality of life in the USA. Discussions were heard by Andrew Hardy and Drs. Edward Teller, John Burke, Margaret Mead, W. Philip Gramm, Chester L. Cooper, and Peter C. Goldmark. (MCW)

7957 MEETING FUTURE WORLD DEMANDS FOR ENERGY. The Role of Nuclear Power. Nicholson, R. L. R. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Atom (London); No. 213, 158-163(Jul 1974).

The subject is discussed under the following headings: introduction; energy supply and demand; nuclear fuel supplies; effect of increased fossil fuel supply; effects of reductions in future demands; environmental constraints; industrial capacity for building nuclear stations; and financial considerations. (UK)

Information Handling

7958 (BMFT-FB-M-73-04) DEVELOPMENT OF AN INTEGRATED INFORMATION SYSTEM FOR MARINE RESOURCES RESEARCH DATA. Ehrismann, W.; Kupfernagel, H. (Bundesministerium fuer Forschung und Technologie, Bonn (F. R. Germany); Zentralstelle fuer Luft- und Raumfahrtdokumentation und -information, Muenchen (F. R. Germany)). Nov 1973. 64p. (In German). INIS.

33 figs.; 8 refs. With abstract in German and English.

A FORTRAN program package for the processing of marine resources research data is described as a basis of an integrated data storage and information system. The system factors are: preprocessing, data file, and method file. The preprocessing part of the system monitors, checks and amends the incoming data, the data file stores them hierarchically, and the method file links the user with the data file. This latter file has the following functions: information, mapping, and trend analyses. Examples of how to apply this system are given. (auth)

7959 (BMVg-FBWT-71-11) MACHINE BASED INFORMATION SYSTEMS FOR DOCUMENTATION. Preliminary Study of the Demonstration Data Processing Project Mechanized Literature Documentation (DEMLID). Graml, H.; Wimmer, K. (eds.). (Bundesministerium fuer Verteidigung, Bonn (F. R. Germany). Dokumentationszentrum der Bundeswehr). May 1971. 314p. (In German).

A detailed description is given of 11 operational computer-based information systems and of 6 other such systems, which are still in the experimental and testing stage. Annexed to the text is an introduction into the major characteristics of another 16 systems. An evaluation technique for determining the scope, equipment, and efficiency of the individual systems is based on a given list criteria. Main criteria for this assessment are: General information, documents, indexing, data organization, retrieval techniques, hardware and software, users, organizational data, system activities, and system control. (GE)

7960 (ORNL-4979, pp 255) HEALTH PHYSICS INFORMATION SYSTEM (HPIS). Hart, J. C.; Holoway, C. F.; Houser, B. L.; Turner, J. E. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

The development of a computerized information system capable of providing input and output for disciplines that make up the health physics profession was undertaken in 1972. Early in 1973, through the cooperation of all sections of the Division, the Health Physics Information System (HPIS) was put into operation. Almost immediately the HPIS interfaced with other technical information systems maintained in the Oak Ridge area so as to provide for more extensive interchange of data. During the past year the Nuclear Safety Information Center (NSIC) dropped its efforts in areas concerned with ecology, thermal pollution, mammalian metabolism, monitoring, and waste management. The HPIS assumed responsibility for mammalian metabolism, monitoring, and waste management as part of its analytical work, with particular reference to external exposure. Included in mammalian metabolism are both normal and abnormal metabolism (physiology and pathology). The HPIS is interfaced with NSIC, Environmental Information Sciences Office (EISO), Comparative Animal Research Laboratory (CARL), Environmental Plutonium Data Base (EPDB), and Computer Sciences Division (CSD). This relationship is in keeping with the unification of information systems facilities so as to minimize duplication of effort. (auth)

7961 (TID-26625) INDEXED LISTING OF INFORMATION SCIENCE DOCUMENTS CATALOGED BY THE TECHNICAL INFORMATION CENTER, U. S. ATOMIC ENERGY COMMISSION. Hardin, N. E.; Worley, C. R.; Patterson, C. B. (USAEC Technical Information Center, Oak Ridge, Tenn.). Sep 1974. 348p. Dep. NTIS $10.60.

The computer-prepared listing provides access to the collection of documents covering the field of information science maintained by the Atomic Energy Commission's Technical Information Center and supersedes the June 1970 edition. These documents have been acquired and announced in support of the Office of Information Service's mission to provide access to the world's literature in the field of energy. The collection emphasizes information storage and retrieval, national and international information systems, subject analysis, automated library techniques, and standards for information processing. (auth)

7962 NUCLEAR ENERGY. Directory Who's Who Buyers's Guide of the Federal Republic of Germany. Dusseldorf, Handelsblatt GmbH (1964). 250p. (In German and English). DM 48.00.

The Directory contains addresses of research institutions, organizations, public authorities, and operators of nuclear power stations of the German nuclear industry. (MCW)

Law

Refer also to abstracts 6822–6834, 6836–6841, and 6843–6854.

7963 (AED-CONF-73-546-003) THE PERSON IN CHARGE OF THE IMPLEMENTATION OF RADIATION PROTECTION REGULATIONS. Puppe, D.; Schoen, D. (Staedtisches Auguste-Viktoria-Krankenhaus, Berlin-Schoeneberg (F. R. Germany). Strahlenabteilung). 1973. 9p. (In German). INIS.

From 14th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Wuerzburg, F. R. Germany (16 Nov 1973).

7 figs. Available from ZAED.

A definition is given of the activities and the duties of the person responsible for the implementation of the radiation protection provisions in accordance with the X-Ray Ordinance, paragraphs 11 and 12: Due to his expert knowledge in this particular field and due to the authority vested into this person as being the operator or person appointed by the operator with regard to the management or supervision of the operation of x-ray installations, it is the duty of the person in charge of the implementation of the radiation protection provisions to see to it that the regulations of the X-Ray Ordinance are observed in the day-to-day business in order to prevent damage to men and materials and to guarantee the lowest possible radiation exposure of the personnel and the general public. This definition is further extended with respect to the special relationship between physician and patient: It is the duty of the physician being an expert in radiation protection and therefore appointed to this post to see to it that the application of x-rays in the treatment of patients will be carried out only after careful risk-benefit analyses, and as skillfully as possible, based upon strict indications. (GE)

7964 COURT STOPS CONSTRUCTION OF NUCLEAR POWER PLANT. City of Schweinfurt Obtains Decision on Suspensive Power. Frankf. Allg.; No. 205, 9(Sep 1974). (In German).

The Administrative Court of Wuerzburg by an indisputable decision reestablished the suspensive power of the action of the city of Schweinfurt against the licensing of the planned nuclear power plant. (GE)

7965 VETOING H.R. 15323, AN ACT TO AMEND THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, TO REVISE THE METHOD OF PROVIDING FOR PUBLIC REMUNERATION IN THE EVENT OF A NUCLEAR INCIDENT, AND FOR OTHER PURPOSES. Message from the President of the United States, Ninety-Third Congress, Second Session. Washington, DC; Joint Committee on Atomic Energy (1974). 8p. GPO.

H. R. 15323 was returned to the House of Representatives without approval by the President with an explanation that the first eleven sections could be approved if they stood alone, but the contents of section 12 do not meet with the President's approval. He charged the Congress with requesting his approval before it has given its own. Section 12 provides that the Act shall become effective thirty days after the date on which the Joint Committee on Atomic Energy submits to the Congress an evaluation of the reactor study, an AEC report on the assessments of accident risks in the U. S. commercial nuclear power plants, except that it shall not become effective if within the thirty day period after the Joint Committee submits its evaluation, the Congress adopts a concurrent resolution disapproving the extension of the Price-Anderson Act. (MCW)

7966 SUPPLEMENTAL AUTHORIZATION OF APPROPRIATIONS FOR THE ATOMIC ENERGY COMMISSION FOR FISCAL YEAR 1975, NINETY-THIRD CONGRESS, SECOND SESSION, HOUSE OF REPRESENTATIVES. Washington, DC; Joint Committee on Atomic Energy (1974). 5p. GPO.

On September 4, 1974, an executive communication was transmitted to Congress requesting consideration on a proposed bill that amends Public Law 93-276, the AEC Fiscal Year 1975 Authorization Act, by providing a supplemental authorization for appropriations of $62,200,000 for operating expenses and $18,300,000 for plant and capital equipment. Hearings were conducted on September 12, 23, and 26. Committee comments were heard on nuclear weapons and safeguards programs. (MCW)

7967 TRANSPORTATION OF HAZARDOUS MATERIALS BY AIR. Hearings Before a Subcommittee of the Committee on Government Operations, House of Representatives, Ninety-Third Congress, First Session, March 14, 15, and April 5, 1973. Washington, DC; Committee on Government Operations (1973). 287p. GPO.

Hearings were conducted to further investigate the problems encountered in transporting hazardous materials by aircraft, particularly passenger-carrying airliners. These materials include radioactive materials; small arms ammunition; etiological agents capable of causing such diseases as cholera, encephalitis, yellow fever, and anthrax, poisonous substances that can cause death or permanent injury by inhalation or contact with the skin; acids of many varieties; radioactive materials; and other commodities that cannot be distinguished should a fire occur on the aircraft. The Department of Transportation's Office of Hazardous Materials and the Federal Aviation Administration presented their views on the problems the Government faces in its effort to effectively guarantee protection to the public against the hazards involved. Written responses to questions submitted to interested companies and other correspondence pertinent to the hearings are included. (MCW)

7968 AEC OMNIBUS LEGISLATION, 1974. Hearings Before the Joint Committee on Atomic Energy, Congress of the United States, Ninety-Third Congress, Second Session on Amending the Atomic Energy Act of 1954, as Amended, and the Atomic Rewards Act of 1955, April 30 and June 18, 1974. Washington, DC; Joint Committee on Atomic Energy (1974). 83p. GPO.

Hearings are presented on an amendment to the Atomic Energy Act proposed by the Atomic Energy Commission that will delete the requirement that Congress authorize the distribution of quantities of special nuclear material to groups of nations, specifically IAEA and EURATOM. Testimony from John Erlewine, General Manager of the AEC, was heard at the two sessions, April 30 and June 18, 1974. The law presently limits the Commission to distributing to the IAEA no more than 5,000 kilograms of contained U-235, plus an amount which matches the sum of such material made available by all other members of the IAEA by July 1, 1960 (this is an additional 70 kilograms). In the case of EURATOM, the Commission is now authorized to provide only that quantity of contained uranium 235 to support the fuel cycle of power reactors having an installed capacity of 35,000 megawatts of electric energy, together with 25,000 kilograms of contained U-235 and 1,500 kilograms of plutonium for other peaceful purposes. This authorization is set forth in the URATOM Cooperation Act of 1958. (MCW)

7969 ANNUAL REPORTS TO CONGRESS ON NUCLEAR INFORMATION. Report by the Joint Committee on Atomic Energy, Ninety-Third Congress, Second Session, House of Representatives. Washington, DC; Joint Committee on Atomic Energy (1974). 47p. GPO.

A bill, S. 3728, to insure that adequate nuclear information essential to Senate decisions be provided to that body is described. The report would provide facts and information concerning nuclear weapons, nuclear energy, and nuclear policies, the knowledge of which would contribute to the exercise of informed judgments by all Senators respecting foreign policy, defense, and international trade. Committee comments, cost of legislation, Bill analysis, and changes in existing law are published. In an Appendix, Sections VIII-XIII of August 1974 Joint Committee print on Membership, Publications, and other pertinent information through the 93rd Congress, 1st session are included. (MCW)

7970 LAW AND REGULATIONS FOR THE PIPINGS IN CONSTRUCTION OF NUCLEAR POWER PLANTS AND THE PROCEDURES FOR APPROVAL. Tamai, Teruo (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo (Japan)). Haikan Gijutsu; 16: No. 4, 106-112(Apr 1974). (In Japanese).

Among the laws and regulations for the construction of nuclear power plants in general, there is the Electric Enterprise Law with its ordinances when only the installation of pipings in nuclear power plants is considered. These then break down into three aspects, namely the plans for construction, the inspection for welding, and pre-service inspection. The law with its ordinances is described with emphasis on the procedures for governmental approval as follows: scheme of the Electric Enterprise Law; construction plans, the technological standard for plant facilities and structures, and aseismatic design; welding inspection, the technological standard of welding, welding method; and inspection before operation. (JA)

Management

Refer also to abstract 6000.

7971 (BNL-19213, pp 19) TRAINING: HEALTH PHYSICS SUMMER TRAINING PROGRAM. Greenhouse, N. A.; Williams, R. D. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

The twenty-fourth annual summer training program for health physics graduate students at BNL took place between June 11 and August 17, 1973. Nineteen graduate students participated in the standard three-part program. In addition, three undergraduate students participated in special on-the-job training, including the orientation portion of the graduate program. (auth)

7972 (BNL-19213, pp 37) PERSONNEL MONITORING RECORDS. Kuehner, A. V. 1 Aug 1974.

In Health Physics and Safety Division annual progress report, January 1–December 31, 1973.

A computer program to maintain all personnel monitoring records has been written and is now in use. The records maintained include: β (surface), γ (penetrating), neutron, internal (whole-body), and extremity exposures as well as number of badges, investigations, and provisions for indication of additional (non-computer) records on each person who has had any positive exposure within the last 60 weeks. (auth)

7973 (CNRS-RA-1972) PROGRESS REPORT (1972). (Centre National de la Recherche Scientifique, 75 - Paris (France)). [nd]. 435p. (In French). Dep. NTIS (US Sales Only) $24.75.

A brief review is given of the work carried out by the CNRS group during 1972 together with the developments that took place during the 1972/1973 period. An inventory is drawn up of the facilities put at the disposition of research (financial aspects, personnel available, equipment, buildings and installation). The CNRS research policy is discussed together with the interrelations between the different disciplines. The scientific sector progress report is divided into seven chapters: matter and radiation including the analytical sciences (nuclear physics, elementary particle physics, theoretical physics, physics of condensed media, atoms and molecules, and plasma physics); engineering sciences (mechanical electronic and electrical components, engineering, instrumentation, metrology, and chemistry); earth sciences, oceanography, and atmospheric sciences; life sciences, human sciences; electronics, computer science, and automation; calculation facilities; pure mathematics, and mathematical methodology. (FR)

7974 (EPA-600/5-74-016) ASSESSMENT METHODOLOGY FOR THE ENVIRONMENTAL IMPACT OF WATER RESOURCE PROJECTS. Warner, M. L.; Moore, J. L.; Chatterjee, S.; Cooper, D. C.; Ifeadi, C.; Lawhon, W. T.; Reimers, R. S. (Battelle Columbus Labs., Ohio (USA)). July 1974. Contract 68-01-1871. 233p. GPO $3.00.

Materials are presented that are intended for use by reviewers of environmental impact statements on major water reservoir projects. The report is prepared as a series of six related but individually referenced discussions of the following major topics: reservoir project planning, construction, and operation activities; water quality impacts of reservoir construction; ecological impacts of reservoir construction; economic, social, and aesthetic impacts of reservoir construction; review criteria for assessing general statement for completeness and accuracy; and a review of impact assessment methodologies. The materials presented attempt to call to the reviewer's attention important issues or potential impacts that an adequate impact statement should address. In addition, the water quality and ecological impacts sections discuss the site-specific conditions under which a given potential impact may or may not occur. The section on water quality impacts also presents a detailed comparison of mathematical models for predicting impacts on water temperature, dissolved oxygen levels, and some chemical constituents of surface waters. The sections dealing with water quality, ecological, and economic-social-aesthetic impacts include extensive citations to relevant literature the impact statement reviewer may wish to consult for further information. (auth)

7975 (GSI-73-5) PUBLICATIONS OF THE UNILAC GROUP, 1966–1972. (Gesellschaft fuer Schwerionenforschung m,b,H., Darmstadt (F. R. Germany)). Oct 1973. 236p. (In German and English).

A comprehensive collection of papers and conference lectures is published by the Gesellschaft fuer Schwerionenforschung (GSI), Darmstadt, Germany, for the period 1966–1972 on the following subjects: stripped heavy ions, electron capture, electron loss and charge exchange of iodine ions, variable-energy, heavy ion linear accelerator (UNILAC), quadrupole ion focusing, multiply charged ions, and ion sources (duoplasmatron, Penning sources). (GE)

7976 (KFK-2025) SCIENTIFIC PUBLICATIONS OF THE NUCLEAR RESEARCH CENTER, KARLSRUHE, PUBLISHED IN 1973. (Kernforschungszentrum Karlsruhe (F. R. Germany)). 1974. 68p. (In German). Dep. NTIS (US Sales Only) $6.50.

The titles of the 1973 publications of the Karlsruhe Nuclear Research Center are compiled and arranged by institute. An author index is also included. (JSR)

7977 (NP-20193) PROGRESS REPORT, 1973–1974. (Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands)). 1974. 85p. Dep. NTIS (US Sales Only) $7.25.

Progress is reported on building the 250 - 500 MeV linear electron accelerator (at 10 - 2½ duty cycle) MEA (Medium Energy Accelerator) and in preparing for the experimental work to be performed with it. The decision was made to make the experimental hall ⅓ the length of the accelerator (known as the 140-MeV hall) to be suitable for electron scattering experiments by moving the present equipment at the 85-MeV accelerator EVA to that station. The electron accelerator EVA can be replaced without much trouble by the 140-MeV station. The cyclotron, though, has possibilities that cannot easily be replaced by MEA, in the field of the production of short-lived radionuclides for biomedical research. In the past year the Phillips-Electrologica X8 computer obtained in 1966 was replaced with a PDP-LAB-10 system. The work of outside groups done at IKO is summarized and includes work in radiochemistry, use of the mass separator built by IKO, and the manufacturing of semiconductors. (MCW)

7978 (NP-20209) STATEMENT BY THE BOARD AND THE MANAGING DIRECTOR FOR 1973. (Aktiebolaget Atomenergi,

Studsvik (Sweden)). 1973. 15p. Dep. NTIS (US Sales Only) $4.00.

Technical research performed at AB Atomenergi for 1973 is summarized. The main task is research and development in the nuclear field to support the large Swedish programs based on light water reactors. Government activities delegated to promote technical and industrial development on the nuclear fuel cycle are performed. Reports are made on development work on reactors and fuel; nuclear fuel cycle; light water reactors and less extensive research on fast and HTGR type reactors; fuel elements and materials testing; uranium recovery and enrichment; and reprocessing of nuclear fuels. Research on non-nuclear energy technology is reported on MHD generators, fusion energy, storage of energy, the gasification of Ranstad shale, and the production of synthetic gas from the shale. The economy of district heating was studied. Safety and the environment, contract work and sales, training programs, dissemination of information, personnel, and economics are briefly considered. (MCW)

7979 (ORNL-4979, pp 253-254) EDUCATION AND VOCATIONAL TRAINING. Fair, M. F.; Hart, J. C.; Turner, J. E. Sep 1974.

In Health Physics Division annual progress report for period ending July 31, 1974.

Surveys show that only 49 undergraduates were enrolled in the fall of 1971 in all subfields of radiation protection among the principal schools that offer radiological training programs. Four bachelor's and 201 graduate degrees were awarded in radiation protection fields between July 1, 1970, and June 30, 1971. Estimates of the numbers of new B.S.-level health physics, technologists needed for various activities by 1985 show the average number of new B.S.-level technologists needed annually is between 300 and 500. The need occurs rather evenly for each activity. The nuclear power program, including fuel recycling operations, requires between 950 and 1500 health physics technologists. Nuclear medicine and other nuclear applications will require between 1200 and 2500. An anticipated increase in federal, state, and local regulatory activities will require an additional 500 to 1000. Between 650 and 1000 additional persons will be needed to replace present workers who will retire, die, or change their specialty. Training programs at ORNL are outlined. (CH)

7980 (SAND-74-5158) AUTOMATION OF ENVIRONMENTAL TEST FACILITIES. Darsey, D. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). [nd]. 5p. (CONF-741001-3). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

The philosophy of facility automation is a dilemma presented many companies today. The basic considerations for development of automated facilities at Sandia Laboratories Albuquerque include total cost, accuracy, control, speed, flexibility, useful life, reliability, and ease of operation and modification. Four operational systems illustrate different applications of philosophy. In addition, trade-offs in automatic facilities, such as hardware versus software, programming languages, and influence of the number of systems produced is explored. (auth)

7981 (TID-26661) INTERAGENCY MECHANICAL OPERATIONS GROUP (IMOG) STEERING COMMITTEE. Meeting 29, January 1974. (Interagency Mechanical Operations Group (USA)). 1974. 54p. Dep. NTIS $5.75.

The activities of the task groups are reported. LASL's Laser Program and Metrication progress are described. Subgroup presentations on Numerical System Status, Environmental Testing Status, Engineering Data Computerization Status, and the Joining Status Reports are included. Discussions on component classification, and LASL's Subterrene and controlled thermonuclear research programs complete the reports. (MCW)

7982 (WASH-1228(74)) NUCLEAR ENGINEERING ENROLLMENTS AND DEGREES. Enrollments, Fall 1973. Degrees Granted, July 1965-June 1973. (USAEC Division of Labor Relations, Washington, D. C.). Jul 1974. 43p. Dep. NTIS $5.25.

The survey of U. S. enrollments and degrees in nuclear engineering revealed the following data: (1) Ph D's decreased to 126 from 149 in 1971-72 and from 181 in 1969-70; (2) MS's increased to 442 from 428 in 1971-72; (3) BS's increased to 551 from 464 in 1971-72; (4) foreign nationals represented 3% of the BS, 13% of the MS, and 22% of the Ph D graduates, smaller percentages of MS and Ph D graduates than the prior year; (5) the percentage of foreign nationals increased among doctoral candidates and undergraduate students, and the percentage among master's candidates decreased; (6) private industry continued to recruit the largest portion of the graduates at all levels; (7) the percentage of BS and MS graduates remaining for further study declined; and (8) women and minority U. S. citizens (black, oriental, Spanish-speaking, or Native American Indian) represent no more than 3% of enrollees or graduates in any category or at any level. (auth)

7983 AEC RADIOLOGICAL ASSISTANCE PROGRAM. Smalley, W. (Atomic Energy Commission, Washington, DC). Trans. Amer. Nucl. Soc.; 19: 196-197(1974).

From meeting of the American Nuclear Society; Washington, District of Columbia, USA (27 Oct 1974). See CONF-741017-.

7984 EXPERIENCE IN THE INTRODUCTION OF NUCLEAR POWER. St. Hood, C. C. (United Kingdom Atomic Energy Authority, Harwell, Eng.). Atom (London); No. 214, 176-190 (Aug 1974).

From symposium on the economics of nuclear power in developing countries; Ankara, Turkey (Jun 1974).

The stages by which nuclear power has been developed in the UK over the past 30 years are reviewed, including the complex administrative and economic problems that have been faced and still have to be faced, and the organizational steps taken to deal with these problems. Headings are as follows: first developments in the UK; the legal and industrial infrastructure; problems in UK reactor development-thermal reactors; the central importance of fast reactors; conceptual approach to the introduction of nuclear power; back-up services--pre-contract assessment; contract supervision; reactor manufacture; staff training; health physics teams; waste disposal at reactor sites; inspection of nuclear plant; and fuel cycle activities. (UK)

7985 POWER INDUSTRY OF THE USSR: ITS PRESENT AND FUTURE. Kirillin, V. A. Atom (London); No. 213, 166-172(Jul 1974).

Mathematics and Computers

Refer also to abstracts 5967, 6291, 6427, 7960, and 7972.

7986 (AECL-4832) CHEBINQ: A FORTRAN PROGRAM TO CALCULATE CHEBYSHEV INEQUALITIES AND GAUSSIAN INTEGRATION PARAMETERS. Winterbon, K. B. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Jul 1974. 44p. Dep. NTIS (US Sales Only) $5.25.

The program CHEBINQ, written in CDC-6600 FORTRAN Extended, uses moments, either power moments or polynomial moments, of a density to calculate upper and lower bounds on the corresponding distribution, and other related quantities. A brief and elementary outline of the theory is given, followed by a description of the program and how to use it, and a program listing. Calculation from power moments is ill-conditioned. If moments induced by polynomials are used, and these polynomials are orthogonal with respect to a weight function similar to the unknown density, much greater accuracy is obtained. Similarly, if the recurrence relation is known for the polynomials orthogonal with respect to the "unknown" density, greater accuracy is obtained. Bounds may be calculated for any point on the real line. If a bound on the density is given, as well as the moments, improved bounds on the distribution are obtained. Gaussian integration points and weights for an arbitrary weight function may likewise be calculated from the moments or the orthogonal polynomial recurrence relation. Gaussian quadratures have certain bounding properties; these are pointed out in the text. A portion of the program can be used to construct continued-fraction approximants to arbitrary power series. A bibliography of applications of Chebyshev inequalities to topics in physics and chemistry has been included. (auth)

7987 (ANL-8127) USE OF THE ARGONNE BENCHMARK COLLECTION TO MEASURE COMPUTER SYSTEM PERFORMANCE. Butler, M. K.; Hirsch, A. (Argonne National Lab., Ill. (USA)). Sep 1974. Contract W-31-109-Eng-38. 201p. Dep. NTIS $7.60.

To measure the performance of fast, large computing systems against a standard system, the authors have prepared a two-part benchmark collection. One part consists of production codes selected as being representative of the AEC-sponsored research and reactor development programs of Argonne National Laboratory. These jobs are run individually to measure the performance multiplier for particular classes of work and together in a multiprogrammed environment to test the interference between jobs. The other part consists of jobs extracted from the daily workload experienced by the Computer Center. These jobs are run as a model job stream in a multiprogrammed environment to measure the throughput multiplier. Additionally, the performances of compilers and system utilities are measured. This report presents the results of an experiment undertaken during the summer of 1971, using the benchmark collection to measure the performance of a CDC 7600 and an IBM 360/195 as part of a computer acquisition

study. Problems encountered by the manufacturers in converting to and running the benchmark collection on their configurations are discussed. Data comparing the performance of each proposed machine to the installed IBM 360/75 system are presented. An analysis of the results and a discussion of the problems anticipated in converting to a new system conclude the report. (auth)

7988 (ANU-P-591) SORTING MEGA DATA AT THE UNIVAC 1108. Graham, I. G. (Australian National Univ., Canberra. Dept. of Nuclear Physics). [nd]. 10p. Dep. NTIS (US Sales Only) $4.00

MEGASORT is a program on the UNIVAC 1108 for sorting mega data accumulated on the 1800. Tapes from the 1800 must first be copied onto 1108 tapes at the 1108. Application of MEGASORT can then sort the data from any number of tapes into any number of windows (total channel length <40K) with projections on any axes, adding the contributions of the different tapes, gain shifted if necessary. At the conclusion of the sort, the windows can be printed on the line printer, plotted on the PDP Calcomp, or written onto another tape in 1800/360 tape format for conventional analysis at any of the three computer installations. (auth)

7989 (BNL-19250) BNL "SIDE DOOR" ACCESS SYSTEM MANUAL. Burgar, L.; Lewis, L.; Peskin, A. (Brookhaven National Lab., Upton, N. Y. (USA)). Aug 1973. 127p. Dep. NTIS $9.50.

The "side door" access system is a modular system designed to allow access to and from Control Data's Extended Care Storage (ECS) for certain special applications. Primary among these applications are BROOKNET, the BNL remote computer network and the direct access Peripheral Processer feature. Data transfers for these applications are conducted through the system with a minimal amount of interaction or interference with the central facility computers that are also connected to ECS. The "side door" coupler is analogous to the ECS Couplers in the CDC 6600 computers and as such it appears to the 6640 ECS controllers as a 6000 computer in its operation. The Coupler and its related modules serve to resolve interface mismatches between the 6640 and the various special applications requiring high speed direct access to ECS. The complete system data flow is depicted. (MCW)

7990 (CALT-767-P12-X1) NUMERICAL ANALYSIS AND COMPUTERING. Progress Report. (California Inst. of Tech., Pasadena (USA)). [nd]. Contract AT(04-3)-767. 3p. Dep. NTIS $4.00.

Tihonov's method for ill-posed problems is being studied, with particular reference to: the backward heat equation, harmonic continuation, and numerical differentiation. Rates of convergence are determined for various norms and for different types of regularization. The moduli of convergence and of regularization are related by a general inequality, which yields an optimal value for the Lagrange multiplier used as a parameter in solutions of Tihonov's minimum problem. Difference methods for general two-point boundary value problems were analyzed and applied for computing flows about gas bubbles up to a Reynolds number of 60. A new approach to the computation of the roll up of a finite vortex sheet was initiated. (MCW)

7991 (CEA-CONF-2654) MICROPROGRAMMING OF AN APL COMPUTER ON A MULTI 20 COMPUTER. de Cosnac, B.; Granger, J. L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Services d'Electronique). 6 May 1974. 10p. (In French). (CONF-740564-1). Dep. NTIS (US Sales Only) $4.00.

From organization meeting on oriented computer language and the oriented computer system; Alpe d'Huez, France (3 May 1974).

7992 (CIC-C-2.2-001) POLYNOMIAL ROOT FINDER. Lawrence, J. D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Dec 1966. 21p. Dep. NTIS $4.25.

-MULLER- is a Fortran II subroutine that may be used to find the real and complex roots of a polynomial. Two versions are available; version A is used if the polynomial has only real coefficients, and version B is used if it has complex coefficients. (auth)

7993 (COO-2383-0013) QUARTERLY TECHNICAL PROGRESS REPORT, APRIL, MAY, JUNE 1974. Poppelbaum, W. J. (Illinois Univ., Urbana (USA). Dept. of Computer Science). [nd]. Contract AT(11-1)-2383. 118p. (UIUCDCS-QPR-74-2). Dep. NTIS $9.00.

Progress is reported on circuit research, hardware systems research, and software systems research. Switching theory and logical design, machine and software organization studies, and combinatorial computing were continued. Progress on ACSES, the Automated Computer Science Education System, to advise students in their choice of lessons based on their goals and past performance is reported. Work on the AQVAL machine perception and intelligence and MESH research projects is summarized. (MCW)

7994 (EUR-5142e) SMART DATA STATION. Bettendroffer, E.; Sorel, F. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). Sep 1974. 40p. Dep. NTIS (US Sales Only) $5.00. EUR B.Fr.60.-.

The features of the terminal SMART allow an effective dialogue between the experimentalist, the data sources of the experiment, and the computer. The terminal performs mainly two functions: data acquisition and control of the experiments instrumentation (e.g. temperature, pressure), and storage and transmission to the minicomputer of data introduced by a keyboard (e.g. selecting of programs). Since the terminal includes a transmission system, the instrumentation of the experiment can be distantly located from the computer. (auth)

7995 (EUR-5173e) SLC-II LANGUAGE TRANSLATION PACKAGE USER MANUAL FOR INPUT. Kolar, W. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). Sep 1974. 98p. Dep. NTIS (US Sales Only) $8.00. EUR B. Fr. 125,-.

The user manual of the input program of the SLC-II system is presented. It gives the functional description of the program and describes the different instructions that are at the disposal of a user to code his problem. An example illustrates the use of the program. (auth)

7996 (GSF-MD-24) STATSYS: DESCRIPTION AND USER MANUAL. Victor, N.; Hoermann, A.; Eder, L. (eds.). (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Muenchen (F. R. Germany). Inst. fuer Medizinische Datenverarbeitung). Mar 1973. vp. (In German).

The program package STATSYS comprises programs for data preparation, descriptive statistics, and a number of statistical evaluation procedures. These programs were developed in order to enable users who are not familiar with the programming of a computer to do their own evaluation of any given data. The program flow can be controlled by the user by means of control cards so that the program can be adapted to the user's requirements and special problems; all the user has to learn is to exactly describe his problem by means of the control cards, and he will find the necessary instructions for the preparation of the control cards in the present manual. The data input procedure of the system was made as flexible as possible. Either binary or decimal-coded data can be used and the data files may be on magnetic tapes, discs, card magazines, or a card deck in the input stream. Due to this flexibility, the system can be easily connected to a data band. (GE)

7997 (LA-5723-MS) SECOND MONTE CARLO SAMPLER. Everett, C. J.; Cashwell, E. D. (Los Alamos Scientific Lab., N. Mex. (USA)). Aug 1974. Contract W-7405-eng-36. 58p. Dep. NTIS $5.45.

Methods are suggested for sampling many additional probability densities occurring in practice, as well as more general forms of some of those appearing in the first SAMPLER. Notably, the frequent restriction to half-integer exponents has been removed. As before, no claim to priority is intended, the sole object being to provide a handbook for Monte Carlo practice. (auth)

7998 (LA-UR-74-1565) REMOTE TRANSIENT DATA ACQUISITION SYSTEM. Stephenson, D. L.; Milich, C. P. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 6p. (CONF-741001-24). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

A transient data acquisition system utilizing two Biomation Model 8100's interfaced via a microprocessor to a microwave data link is described. The operational requirement is to allow for remote operation from the control point some ten miles from the shot site where the acquisition equipment is located. Both 8100 2K volatile memories must be dumped into hard memory and the first 335 data samples transmitted to the CP prior to the arrival of the ground shockwave some 700 milliseconds after the event. The microprocessor provides all 8100 controls as well as core memory addressing during a quasi-DMA input data transfer routine. The microprocessor treats the microwave data link simply as another I/O peripheral, and supplies all controls and timing required for the remote data transmission. Remote operator controls as well as local controls are also treated as I/O peripherals, and control switch settings are executed as software branch service routines. Other system peripherals include a CRT display, line printer, and magnetic tape recorder. (auth)

7999 (LA-UR-74-1608) COMPUTER AIDED DESIGN OF ELECTRONIC CIRCUITRY. Freyman, R. W.; Martinez, P. H. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. Contract W-7405-eng-36. 6p. (CONF-741001-16). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

The advent of computerized Automatic Network Analyzers (ANA)

that measure the scattering (s) parameters of a two-port active or passive device accurately and rapidly has motivated the generation of new programs utilizing the s-parameters directly in the Computer Aided Design of electronic circuitry. The s-parameter model, for linear steady state design problems, eliminates the need for the measurement idealization of 28 transistor parameters when only the linear steady-state solution is required. All of the known programs presently available on commercial time share services have been evaluated with benchmark problems. The utility of each program for optimization, accuracy, and cost-effectiveness is discussed. (auth)

8000 (ORNL-4596) USER'S MANUAL FOR THE GRAPHICS PACKAGE ORGRAPH. Nestor, C. W. Jr.; Chandler, K. C.; Gove, N. B.; McDowell, J. D. (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 118p. Dep. NTIS $5.45.

A package of subroutines was prepared to facilitate the use of the plotting equipment available at the ORNL-site Computing Center. A wide variety of data plotting, function plotting, and labeling options is available for any of the plotters. (auth)

8001 (ORNL-tr-2858) DESCRIPTION OF PASCAL MAGNETIC TAPES. (Centre National de la Recherche Scientifique, 75-Paris (France)). 1 Jan 1973. Translation by R. G. Mansfield of Descriptif des Bandes Magnetiques Pascal. 14p. Dep. NTIS $4.00.

The concern of the documentation center of the CNRS in the definition of a magnetic tape format for 1973 has been mainly to provide for the coming application of the definitions given in the "Reference Manual for the Preparation of Machine-Readable Bibliographic Descriptions" published by the ICSU-AB and conforming to the norm ISO/DIS 2709. The emphasis has been on the definition of the concepts contained in the card index without changing the mode of access used for the 1971 and 1972 tapes. Thus two fields have been redefined, the field "vignettes" (publication type) containing variables defining the document processed and the field "bibliographic references" whose subfields have been provided with identifying flags (PA for pagination, NO for number). (auth)

8002 (RISO-M-1743) USE OF CAUSE-CONSEQUENCE CHARTS IN PRACTICAL SYSTEMS ANALYSIS. Nielsen, D. S. (Danish Atomic Energy Commission, Risoe. Research Establishment). Sep 1974. 24p. (CONF-740906-3). Dep. NTIS (US Sales Only) $4.25.

From conference on reliability and fault tree analysis; Berkeley, California, USA (3 Sep 1974).

The paper outlines the strategy and the main steps of cause-consequence analysis based on the concept of critical events. The so-called cause-consequence chart used for display in connection with cause-consequence analysis and for documentation purposes is described. Examples are given. (auth)

8003 (RISO-M-1747) COMPUTER ABSTRACTS. Hansson, L.; Klaerulf, H. (eds.). (Danish Atomic Energy Commission, Risoe. Research Establishment). Sep 1974. 33p. Dep. NTIS (US Sales Only) $4.75.

A listing of abstracts is given that concern sequences and computer programs at the B6700 Computer Installation at Risö. The list only includes items that are considered to be of general use. Information about programs of a more specific nature is available with authors. (auth)

8004 (RT/EL-(74)4) USE OF KARNAUGH MAPS WITH FOUR VARIABLES FOR THE MINIMIZATION OF FUNCTIONS CONTAINING MORE THAN FOUR VARIABLES. Serra, A. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Apr 1974. 8p. (In Italian). Dep. NTIS (US Sales Only) $4.00.

A method is described for the application of four variables Karnaugh maps to the minimization of Boolean functions containing up to eight variables. (tr-auth)

8005 (RT/EL-(74)5) MINIMIZATION OF A COMBINED LOGIC CIRCUIT BY USE OF THE "EXCLUSIVE OR". Serra, A. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Apr 1974. 12p. (In Italian). Dep. NTIS (US Sales Only) $4.00.

A method is described that states in a simple way, the EXCLUSIVE-OR of a Boolean function. The related logic network may be accomplished by means of AND, OR, and EXCLUSIVE-OR integrated circuits. A reduction in number of inputs and of integrated circuits is often achieved by this procedure. (tr-auth)

8006 (SAND-74-5569) ACCESS CATALOGING SYSTEM FOR COMPUTER PROGRAMS. Von Riesemann, W. A.; Allensworth, J. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 6p. (CONF-741001-25). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

ACCESS is a central reference system to structural mechanics programs at Sandia Laboratories. The primary objectives of the system are to provide quick identification of available programs, to furnish all needed information for their use, and to maintain the programs properly. This latter point includes identifying a sponsor for each program, defining standards and procedures for writing and issuing of manuals, and establishing guidelines for checking out programs. ACCESS consists of a cross-referenced index of available programs, and for each program an abstract, a code description sheet, and documentation all filed at one central location. Depending on its status, a program is either available from the permanent files on the CDC-6600, or from an ACCESS magnetic tape in UPDATE form. Due to time and manpower restraints there are several problems in the working of the system, mainly in keeping the status of programs up to date, in checking out programs, and in writing users manuals. (auth)

8007 (SLA-74-0285) FAILURE TOLERANT DISTRIBUTION NETWORKS. Simmons, G. J. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1974. Contract AT(29-1)-789. 51p. Dep. NTIS $5.75.

A problem in the design of communication systems, explosive distribution networks, command, and control systems, is to determine those networks having a minimum number of two-way communication links that can tolerate k independent failures of links without degradation of the system. A considerable literature is devoted to the symmetric problem in which the nodes are treated as indistinguishable, i.e., of k-edge connected graphs. This models, for example, an intercom system in which all of the stations are masters, but does not model most problems that arise in the areas mentioned where there is normally a specified originating source for the signal to be distributed by the network. The asymmetric case in which one vertex of the network is distinguished as the source and the other n vertices are considered as outputs. The question of characterizing those networks (graphs) having the least number of edges L(k,l,n) such that cutting k edges cannot isolate more than l outputs from the source is posed and partially answered. (MCW)

8008 (SU-326-P18-X8) SYSTEMS OPTIMIZATION PROJECT. Appendix. Progress Report, 1 October 1973-30 July 1974. Dantzig, G. B.; Cottle, R. W.; Eaves, B. C.; Wilson, R. B. (Stanford Univ., Calif. (USA)). 1974. Contract AT(04-3)-326. 59p. Dep. NTIS $6.00.

A summary of computational work and software development for structured linear programming, general linear programming, quadratic programming and linear complementarity, and general nonlinear programming is presented in this Appendix of the progress report for Oct. 1, 1973 to July 30, 1974. Twelve abstracts to papers pertaining to the data are presented and then bibliographic data are presented for the authors. (MCW)

8009 (UCID-3656) COMPARISON OF THREE ONLINE INFORMATION RETRIEVAL SERVICES. Zais, H. W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Apr 1974. Contract W-7405-eng-48. 31p. Dep. NTIS $4.75.

The report provides a concise guide to the data bases offered by three firms for online information searching. These are Lockheed Information Service (using Lockheed's DIALOG system), System Development Corporation (using SDC's ORBIT II retrieval program), and Western Research Application Center (using WESRAC's DATACON system). The selection of these firms is not intended to be an endorsement to the exclusion of others that may be suitable. (MCW)

8010 (UCID-16142) PATTERN RECOGNITION TECHNIQUES FOR PREDICTING PERFORMANCE. Kowalski, B. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Oct 1972. Contract W-7405-eng-48. 21p. Dep. NTIS $4.25.

A package of computer programs was developed called RECOG that can identify patterns in experimental data that are difficult to recognize by conventional means. These pattern recognition techniques correlate the measured properties of manufactured parts with their performance and thus predict from analytical data whether or not a part will perform satisfactorily. The procedure was applied to many chemical problems, including problems of source identification, compound screening, and material production problems. The report presents the results of two successful applications to material production problems. (auth)

8011 (UCID-16247) NOTES ON THE MATHEMATICAL EXPRESSION FOR BANDWIDTH-LIMITED PULSES. Saroyan, A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Mar 1973. Contract W-7405-eng-48. 21p. Dep. NTIS $4.25.

The duration Δt of a pulse and its frequency bandwidth $\Delta\nu$ (Hz) are related for bandwidth-dependent pulses by an expression of the form $\Delta\nu\,\Delta t = \epsilon$. A bandwidth-limited pulse is expressed by this

same form in which the value of ϵ is the smallest of all possible values of the product $\Delta\nu\,\Delta t$. The value of ϵ depends on two factors: the distributions of t and ν and the measures of these distributions that $\Delta\nu$ and Δt represent. The relationship of bandwidth limits and bandwidth dependences to these two factors is presented along with the origin, meaning, and method of verifying bandwidth limits and dependences. The popular expression "$\Delta\nu\,\Delta t = 1$" and interpretation that Gaussian pulses are the bandwidth limit for any measure of $\Delta\nu$ and Δt are shown to be in error. (auth)

8012 (UCID-16621) DATA REDUCTION SCHEME FOR LASER DOPPLER INTERFEROMETERS. Kamegai, M.; Carpluk, G. T. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Mar 1974. Contract W-7405-eng-48. 22p. Dep. NTIS $4.25.

A data reduction scheme for laser Doppler interferometers is described. The computer algorithm is built on the assumption that the fringe pattern of the interferometer is given by $I = A\cos^2(\phi_0 + 2\pi\tau U/\lambda_0)$, where τ is the transit time along the optical delay, and λ_0 the wavelength. The fringe data from the interferometric measurements is analyzed by segments. At every point where the slope of the fringe pattern is radically altered, a reading is taken according to the formats that are attached to the report. The data correction and then the conversion of the data into velocity plots are performed on a 7600 computer. In order to demonstrate the applicability of the scheme, the data on the interferometric measurement of aluminum free surface velocities is processed by the prescribed method. The computer programs are attached for the convenience of the user. (auth)

8013 (UCID-30096) COMPLEX: A PROGRAM FOR EVALUATING EXPRESSIONS CONTAINING COMPLEX VARIABLES. Knox, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 7 Oct 1974. Contract W-7405-eng-48. 11p. Dep. NTIS $4.00.

COMPLEX, a general-purpose program for evaluating expressions containing complex variables, is available as an executable code for the CDC 7600 computers of the Livermore time-sharing system. Input to COMPLEX is provided interactively at the teletypewriter. The program evaluates an expression of the form W = f(Z1,Z2,Z3, ...), where the Zn parameters (up to 9 are permitted) represent variables or constants (real or complex), or functions built up of such variables or constants. Output may be tabular or graphical. (auth)

8014 (UCRL-Trans-10659) STATISTICAL ANALYSIS AND SPECTRAL RESTITUTION OF TECHNICAL SURFACES PROFILES. Leroy, A. Translated from CIRP, Ann. Int. Inst. Prod. Eng. Res.; 21: No. 1, 145-146(1972). 26p. (CONF-720866-1). Dep. NTIS $4.50.

From International Institution for Production Engineering Research conference; Stockholm, Sweden (28 Aug 1972).

The analytical study of technical surface profiles shows that characteristic periodic terms are contained and cannot be measured significantly. The method best adapted to profile representation is a trigonometric series, best given by Fourier. The calculation chain is described and applied to illustrations of a frosted glass used for calibrating the DIAVITE system and to a small steel plate finely ground. (MCW)

8015 INTEGRAL EQUATIONS VIA IMBEDDING METHODS. Kagiwada, H. H.; Kalaba, R. Applied Mathematics and Computation, No. 6. Reading, MA; Addison-Wesley Publishing Company (1974). 395p. $19.50.

Methods are given for transforming integral equations into initial value problems or Cauchy problems. The methods apply to linear and nonlinear integral equations, singular integral equations, eigenvalue problems for integral operators, and to bifurcation problems. The methods are eminently suited to the ability of modern analog and digital computers to resolve initial value problems. (SFL)

Miscellaneous

8016 (ANL-8060(Pt.4)) RADIOLOGICAL AND ENVIRONMENTAL RESEARCH DIVISION ANNUAL REPORT, JANUARY–DECEMBER 1973. (Argonne National Lab., Ill. (USA)). 1973. Contract W-31-109-Eng-38. 98p. Dep. NTIS $5.45.

Twelve papers on meteorological studies and atmospheric physics research are presented. A separate abstract was prepared for each of 8 papers. (LCL)

For abstracts of individual papers see: 6006–6009 and 8017–8020.

8017 (ANL-8060(Pt. 4), pp 55-67) STABILITY DEPENDENCY OF ATMOSPHERIC DISPERSIVE PROPERTIES NEAR THE SURFACE. Hicks, B. B. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

The extent to which current micrometeorological knowledge can be used to describe the relevant turbulence statistics near the surface is discussed using recent data obtained over Lake Michigan. A few examples of the manner in which changes in surface roughness influence the magnitude of the angular dispersive property of the wind in the horizontal plane at low levels are given. (LCL)

8018 (ANL-8060(Pt. 4), pp 70-77) MINIMIZING ERRORS IN INERTIAL SUBRANGE SPECTRAL ESTIMATES. Hart, R. L. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Various methods of measurement, each with its own advantages and problems, may be used to determine the vertical turbulent fluxes of heat, moisture, and momentum in the surface boundary layer. Data acquisition and reduction procedures are discussed which may be used to minimize errors in turbulence spectra data which have been obtained by digital computation. (LCL)

8019 (ANL-8060(Pt. 4), pp 78-84) PRELIMINARY COMPARISON OF ACOUSTIC SOUNDER RECORDS AND HIGH-RESOLUTION PROFILES OF TEMPERATURE AND WIND. Miller, E. L. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Measurements of atmospheric structure and rapid changes in that structure, principally wind and temperature variations at various levels, made by acoustic techniques are compared with simultaneous measurements using high-resolution radiosonde system. The ability of the acoustic sounder to reveal rapid changes in inversion height was demonstrated. (LCL)

8020 (ANL-8060(Pt. 4), pp 85-92) DIGITIZATION OF ACOUSTIC SOUNDER DATA. Hess, P. E.; Wesely, M. L. 1973.

In Radiological and Environmental Research Division annual report, January–December 1973.

Acoustic sounders have been used to obtain information on inversions in the atmosphere. A preliminary interpretation of digitized sounder information is presented and some methods of presenting the digital transcriptions graphically are described. (LCL)

8021 (EDFB-IBP-74-7) ECOSYSTEM MODEL FOR THE PELAGIC ZONE OF LAKE WINGRA. MacCormick, A. J. A.; Loucks, O. L.; Koonce, J. F.; Kitchell, J. F.; Weiler, P. R. (Oak Ridge National Lab., Tenn. (USA)). Oct 1974. Contract W-7405-eng-26. 93p. Dep. NTIS $5.45.

The status of an open-lake model for the pelagic zone of Lake Wingra, designed to simulate the transfer of bio-mass at a relatively aggregated level of resolution is described. Although the resolution of the whole model is intended to be gross, and thus the output cannot be expected to show the sharp variation of individual process sub-models, the pelagic zone model leans very heavily on the lessons learned from the process sub-models. The parameters required by the whole-lake model were estimated by way of the process sub-models. The pelagic zone ecosystem model described is a preliminary statement indicating the current state of the science. (MCW)

8022 (EUR-5171) 15TH 1973 METEOROLOGICAL YEARBOOK. Bollini, G.; Galva, A.; Gandino, C.; Maranzana, E. (Commission of the European Communities, Ispra (Italy). Joint Nuclear Research Center). 1974. 62p. (In Italian). Dep. NTIS (US Sales Only) $6.25. UK BF 85.

After a short description of the methods for measuring and elaborating atmospheric phenomena, many tables and graphics for the meteorological year 1973 are reported. With the observatory's data, the flow of the "Novellino" brook and 4 tables with the stability categories are added. (tr-auth)

8023 (PTB-W-3) EFFECT OF REMOTE SIGNALING LINES ON FIRE AND EXPLOSION-PROTECTED CIRCUITS. Schebsdat, F. (Physikalisch-Technische Bundesanstalt, Braunschweig (F. R. Germany). Abt. Waerme). Jul 1974. 80p. (In German). Dep. NTIS (US Sales Only) $7.00.

Thesis. Submitted to Univ. of Berlin.

In mines with fire damp dangers and operations with explosion danger signals and measurement values must often be transmitted over several km. The transmission of signals was evaluated with respect to the ignition danger on the basis of concentrated values for capacity and inductivity, The ignition behavior of the transmission lines were discussed from the viewpoint of purely capacitive ignition behavior, capacitive ignition behavior modified by the voltage source, and capacitive-inductive ignition behavior modified by the voltage source. (JSR)

8024 (UCID-16069) ADD-ON SYSTEM FOR RECOVERING AIRBORNE OBJECTS. Platt, E.; Cornwell, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 May 1972. Contract W-7405-eng-48. 18p. Dep. NTIS $4.00.

A system for soft landing airborne objects such as space propulsion components is proposed. The system could be added to existing equipment without essential redesign and would allow its recovery and reuse. While the method proposed has general application for saving relatively fragile bodies, it is applied here to the recovery of the Saturn-5 first stage booster. It is estimated that the added weight of the system with a peak deceleration of 1.5 g's would be less than 20% of the dry booster weight. (auth)

8025 (UCID-16186) SOME PROJECTION METHODS IN ATMOSPHERIC SIMULATION. Sincovec, R. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). Aug 1972. Contract W-7405-eng-48. 46p. Dep. NTIS $5.50.

The use of Galerkin and collocation techniques for the numerical solution of chemical kinetic transport equations referred to as synthesis techniques, reduce the original partial differential equations to a system of time dependent ordinary differential equations. In the case of the equations that are central to air pollution and atmospheric physics, the resulting differential equations are often stiff and special integration techniques, such as the methods of C. W. Gear, need to be used. The proposed methods in their simplest form are presented. In the case of the cubic Hermite collocation method, severe rounding errors prevented a reasonable solution from being obtained on simple air pollution problems with special properties. In general, the cubic Hermite collocation method should give excellent results on a large class of problems. (auth)

Chemistry

8026 (BDX-613-1121(Rev.)) PREPARATION OF A CTBN-MODIFIED EPOXY RESIN. Smith, C. H. (Bendix Corp., Kansas City, Mo. (USA)). Nov 1974. Contract AT(29-1)-613. 19p. Dep. NTIS $4.00.

The chemistry of the various types of reactions possible between a carboxyl-terminated butadiene/acrylonitrile (CTBN) liquid copolymer and a diglycidyl ether of bisphenol A (DGEBA) type epoxy resin to prepare a CTBN/DGEBA adduct is discussed. Both a dilution and a non-dilution synthesis technique are described. Several properties of the CTBN precursor and the modified epoxy resin were determined and are presented. (auth)

8027 (CEA-R-4613) REACTION OF SULFUR DIOXIDE WITH FLUORINE. Vanderchmitt, A. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Genie Radioactif). Oct 1974. 168p. (In French). Dep. NTIS (US Sales Only) $11.50.

Up to 500°C, the fluorination of sulfur dioxide yields very quickly, sulfuryl fluoride. If the quantity of fluorine is high enough, sulfur hexafluoride appears slowly at 200°C. This product is preceded by the formation of thionyl fluoride, thionyl tetrafluoride, pentafluorosulfur hypofluorite. After a description of experimental method, a diagram of various possible reactions occurring between fluorine and sulfur dioxide and also approximated values of kinetic constants for these reactions are given. (tr-auth)

8028 (CONF-741023-2) ORGANICALLY COMPLEXED COPPER, ZINC, AND CHELATING AGENTS IN THE RIVERS OF WESTERN PUERTO RICO. Montgomery, J. R.; Echevarria, J. E. (Puerto Rico Nuclear Center, Mayaguez). 1974. Contract AT-(40-1)-1833. . 26p. Dep. NTIS $4.50.

From 7th materials research symposium; Gaithersburg, Maryland, USA (7 Oct 1974).

The method for soluble chelators determines the concentration in copper equivalent chelating capacity units in freshwater or slightly brackish (<3‰ salinity). The mean concentration of chelators in the Río Guanajibo for December 1973 and January 1974 was 0.4 mg Cu/l (N = 21, SD 0.2) and 0.9 mg Cu/l (N = 8, SD 0.4) for February 1974. The combined mean for the Río Añasco and Culebrinas was 0.5 mg/l (N = 7, SD 0.4) in January–February 1974. The mean concentration of ionic copper was 0.5 μg/l (N = 7, SD 0.6) and ionic zinc 0.2 μg/l (N = 8, SD 0.1) in the Río Guanajibo from November 1972 to February 1973. The organically bound copper was 0.3 μg/l (N = 7, SD 0.2) and the organically bound zinc was 0.6 μg/l (N = 8, SD 0.6) indicating that there was more than sufficient quantity of chelator available in the river to complex all the soluble copper. The presence of a high $(Ca^{2+})/(Cu^{2+})$ ratio probably prevents the formation of larger concentrations of organically complexed copper. The mean concentration of chelating agents in the Guanajibo River seems to be directly related to the increased organic input from municipalities and a sugar mill. The concentration of chelators in tropical rivers appears to be higher than found in Canadian lakes. (auth)

8029 (IEA-328) MOLECULAR DYNAMICS OF TERT-BUTANOL STUDIED BY NEUTRON TRANSMISSION. Amaral, L. Q.; Fulfaro, R.; Vinhas, L. A. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Mar 1974. 13p. Dep. NTIS (US Sales Only) $4.00.

Neutron transmission of the globular compound tert-butanol $(CH_3)_3COH$ was measured in the temperature interval 0°C to 40°C for 6.13 Å neutrons and in the neutron wavelength range 4 Å to 7.5 Å in the liquid and solid states. Results show that the cross-section difference at the state transition in 24°C is 13%, while it is only ~1% at the first order phase transition in 14°C. Evidence of existence of a third crystalline phase with the lowest cross-section was found. The barrier to interval methyl rotation in the solid state is estimated as (3.8 ± 0.5) kcal/mol and does not change much over the phase and state transitions. The observed dynamical changes must be due to movements of the whole molecule and evidence that tert-butanol is not in the strict sense a plastic crystal. Correlation with heat capacity results is discussed. (auth)

8030 (LBL-2397) ESCA RESULTS VERSUS OTHER PHYSICAL AND CHEMICAL DATA. Shirley, D. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Feb 1974. Contract W-7405-eng-48. 15p. (CONF-740429-2). Dep. NTIS $4.00.

From international conference on progress in research and applications of electron spectroscopy; Namur, Belgium (16 Apr 1974).

X-ray photoemission spectra yield quantities of direct interest in physics and chemistry. The relations of these spectra to other data and concepts are discussed. Both initial- and final-state properties are studied. (SFL)

8031 (LBL-2795) HYDROXYL RADICAL KINETICS: REACTION WITH OZONE AND VIBRATIONAL QUENCHING. Streit, G. E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). 23 Aug 1974. Contract W-7405-eng-48. 152p. Dep. NTIS $10.75.

Thesis.

Rate constants for the gas phase reaction of vibrationally excited hydroxyl radicals ($4 \leq v \leq 9$) with ozone and for vibrational quenching of hydroxyl radicals by argon, hydrogen, nitrogen, oxygen, and deuterium were measured. The relative rates of formation of hydroxyl radicals into each of six vibrational levels were measured. The technique used was to measure the pressure dependence of hydroxyl radical chemiluminescence emission from the $\Delta v = 4,5$, or 6 overtone bands in the wavelength region 5500Å to 8500Å. Vibrational populations were derived from the emission spectra by finding the set of populations that gave the best fit between an observed spectrum and a synthetically calculated spectrum. Rate constants were derived by interpreting the dependence of vibrational populations on reactant pressure in terms of a comprehensive model of the hydroxyl system. The model restricted vibrational quenching to single quantum steps. Rate constants for the hydroxyl reaction with ozone were found to be highly dependent on the hydroxyl vibrational level and to be a lesser function of the number of product channels available. Vibrational quenching constants were found to be a complex function of vibrational level, exhibiting a maximum at $v = 6$ or 7. (auth)

8032 (LBL-3169) INFRARED PROPERTIES OF SOLIDS UNDER HIGH PRESSURE: CHLORINATED BENZENES AND INORGANIC CARBONATES. Glienna, R. F. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 50p. Dep. NTIS $5.50.

Thesis.

An investigation was made of the infrared spectra of 1,2,4,5-tetrachlorobenzene, 1,4-dichlorobenzene, and four naturally occurring carbonate minerals at pressures of up to 35 kilobars. Intermolecular effects manifest in the vibrational spectra are explained within the context of vibrational coupling through transition dipoles. One and two dimensional models to simulate real crystals are used. Results of dipole-dipole interaction calculations are compared with the experimental data. The possibility of calculating bulk properties of materials through the use of their infrared spectra is discussed. (auth)

8033 (UCID-16007) HIGH-PRESSURE MECHANICAL PROPERTIES OF POLYMETHYLMETHACRYLATE. Stephens, D. R.; Heard, H. C.; Schock, R. N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 30 Mar 1972. Contract W-7405-eng-48. 20p. Dep. NTIS $4.00.

Equation of state data, including pressure-volume, static and dynamic elastic constants, failure envelope (uniaxial compression), and uniaxial strain in loading and unloading tests are presented for polymethylmethacrylate (PMMA), ($\rho_0 = 1.185$ g/cc). Compressibility to 40 kb is found to be relatively rate independent over the range 10^{-5} to 10^{-3} sec. In contrast, moduli that are dependent upon differential stresses and strains, and the shear strength be-

yond the elastic limit, appear to be very strain-rate sensitive. (auth)

8034 (UCID-16117) MIXING PROCEDURE FOR ADIPRENE L-100 AND MOCA. Jessop, E. S.; Buckner, A. T.; Lepper, J. K.; Hammon, H. G. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Sep 1972. Contract W-7405-eng-48. 15p. Dep. NTIS $4.00.

Three production-oriented mixing procedures were evaluated and a hand mixing procedure was developed for Adiprene L-100/MOCA. The between-mix variation was reduced to a tolerable minimum and the finished material was found to be highly reproducible and predictable. The stoichiometric relationship of the components, the mixing method, and the cure cycle have a profound effect on the time required to reach steady state cure. The hand mixing procedure developed at LLL, with MOCA to 95% stoichiometric level, will produce steady-state cure in one week if the Adiprene is cured 3 hr at 100°C; ambient cured material requires 75 days. (auth)

8035 (UCID-16145) FEFO PROCESSING AT AEROJET, MAY 1969. Snoeberger, D. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Jun 1970. Contract W-7405-eng-48. 14p. Dep. NTIS $4.00.

The modification of the system to convert nitromethane to FEFO through the intermediates A-diol and FDNE is described using a 50-gal reactor. The process begins with batch fluorination of a basic solution of A-diol in the reactor. Guidance for design and operation of pilot plant-scale equipment at LRL for preparation of fluoronitrocarbon compounds is provided. Production of FEFO from sodium aci-1,1-dinitroethanol is described. (MCW)

8036 (UCID-16146) PROCESS DESIGN FOR AQUEOUS FLUORINATION OF NITROFORM TO FLUOROTRINITROMETHANE ON A 1 KG SCALE. Snoeberger, D. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Feb 1972. Contract W-7405-eng-48. 51p. Dep. NTIS $5.75.

A process was designed for preparation of fluorotrinitromethane (FTM) by fluorination of nitroform (NF) on a 1 kg scale, and equipment was installed in the HE Chemistry complex at Site 300. Procedures were written and the system is ready for start-up testing. In this design the fluorination of NF in aqueous solution is carried out semi-continuously in a packed column at near 0°C. Fluorine gas diluted with nitrogen gas to about 50% by volume is added at a rate near 1 liter per minute. Aqueous NF solution, 10 to 50 wt %, is metered into the fluorinator at a few hundred ml per min. The NF feed solution may be premixed with NaOH or buffering agents to adjust pH to desired values for fluorination. Sodium fluoride or other fluorides may consequently appear as a solid phase in the fluorinator and receivers. Solution preparation equipment is cooled to remove the small heats of dilution and the heat of neutralization of NF, and to pre-cool the feed to the fluorinator. The fluorination reaction is exothermic, about 130 kcal/mole of NF; it requires good cooling to control the reaction and to keep the reactants within the desired temperature range for good yield and purity. The cooling coil area in the fluorinator is probably the feature limiting the attainable rate of fluorination. To desensitize the FTM as it is made, it is received in CH_2Cl_2-filled vessels. (MCW)

8037 (UCID-16206) LLL ATMOSPHERIC DATA LIBRARY. Edition 4. Duewer, W. H.; Gelinas, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Jan 1973. Contract W-7405-eng-48. 39p. Dep. NTIS $5.00.

The library is a collection of evaluated or estimated rate data for atmospheric reactions for most homogeneous gas phase reactions likely to play a major role in the stratosphere and a limited set of reactions designed for the modeling of tropospheric smog. It does not include reactions of organic compounds containing more than three carbon atoms, ionic reactions, many excited state reactions, or heterogeneous reactions. The rate constants quoted fall into three categories: evaluated rate constants, unevaluated data, and estimated rate constants. (MCW)

8038 (UCID-16208) USER'S GUIDE TO LLL ATMOSPHERIC DATA LIBRARY ORDERED BY REACTION NUMBER. Edition 4. Duewer, W. H.; Gelinas, R. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 8 Jan 1973. Contract W-7405-eng-48. 40p. Dep. NTIS $5.00.

The library contains data for most homogeneous gas phase reactions concerning the stratosphere and a limited set of reactions designed for the modeling of tropospheric smog. It does not contain reactions of organic compounds containing more than three carbon atoms, ionic reactions, many excited state reactions, or heterogeneous reactions. Rate constants are tabulated for evaluated rate constants, unevaluated data, and estimated rate constants. (MCW)

8039 (UCRL-13607) INVESTIGATION OF DATA PROCESSING AND SIMULATION TECHNIQUES FOR CHEMISTRY INSTRUMENTATION SYSTEMS. Final Report. Brubaker, T. A. (Colorado State Univ., Fort Collins (USA). Dept. of Electrical Engineering). 15 Aug 1974. Subcontract 2439905. 96p. Dep. NTIS $8.00.

For Lawrence Livermore Lab.

Described are the investigation of rate distortion theory for the dynamic bandwidth compression of chemistry data; the investigation of digital hardware to reduce error due to finite length arithmetic in digital signal processing algorithms; the continued investigation of digital and hybrid simulation methods to aid the chemist in the evaluation of chemistry data processing and control systems; and the teaching of four one-week short courses on methods of signal processing to chemistry personnel. Four technical reports were written and are included as appendices. (MCW)

8040 (Y-1956) DETERMINATION OF ARSENIC AND SELENIUM IN SURFACE WATER BY ATOMIC ABSORPTION TO SUPPORT ENVIRONMENTAL MONITORING PROGRAMS. King, H. G.; Morrow, R. W. (Oak Ridge Y-12 Plant, Tenn. (USA)). 4 Nov 1974. Contract W-7405-eng-26. 14p. Dep. NTIS $4.00.

A method was developed for determining arsenic and selenium in surface water by atomic absorption. The two elements are hydrided in acidified water by sodium borohydride to form arsine and selenine gases, which are then passed into a low-temperature argon/air/hydrogen flame for the atomic absorption measurement. A background correction is made by adjusting the gas flow rates. The limit of detection is 5 μg/l for arsenic and 1 μg/l for selenium. The method is both fast and economical. (auth)

Life Sciences

8041 (BNL-19219) EXPERIMENTAL STUDIES OF POLLEN DEPOSITION TO VEGETATED SURFACES. Raynor, G. S. (Brookhaven National Lab., Upton, N. Y. (USA)). 1974. 32p. (CONF-740921-10). Dep. NTIS $4.75.

From atmosphere-surface exchange of particulate and gaseous pollutants symposium; Richland, Washington, USA (4 Sep 1974).

Deposition to the ground was measured during experimental studies of natural pollen dispersion from circular and rectangular area sources of cultivated plants and from potted plants arranged in movable line sources. (auth)

8042 (BNWL-1822) ECOLOGICAL ASSESSMENT OF ENERGY AND CARBON PATHWAYS IN SWARDS OF BROMUS TECTORUM L. ON CONTRASTING SLOPE EXPOSURES. Hinds, W. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Aug 1974. Contract AT(45-1)-1830. 147p. Dep. NTIS $10.50.

The fates of energy and carbon were determined on steep (40°) north- and south-facing slopes on a small earth mound, using small lysimeters to emulate swards of cheatgrass (Bromus tectorum L.). Meteorological conditions and energy fluxes measured included air and soil temperatures, relative humidity, wind speed, incoming shortwave radiation, net all-wave radiation, heat flux to the soil, and evaporation and transpiration separately. The fate of photosynthetically fixed carbon during spring growth (31 March to 31 May) was determined by analysis of the plant tissues into mineral nutrients, crude protein, crude fat, crude fiber, and nitrogen-free extract (NFE) (the proximate analysis scheme routinely used for feed analysis) for roots, shoots, and seeds separately. (auth)

8043 (BNWL-SA-3161) ECOLOGICAL IMPORTANCE OF SNOW DRIFTING IN THE DESERT BIOME. Hinds, W. T. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). 2 Apr 1970. 10p. Dep. NTIS $4.00.

8044 (CEA-CONF-2679) IODINE DEFICIENCY FROM GOITER AND DISEQUILIBRIUM IN THE TRANSPORT OF ELECTROLYTES IN MAN. Riviere, R.; Comar, D.; Girault, M.; Colonomos, M.; Roche, M. (CEA, 91 - Orsay (France). Service Hospitalier Frederic Joliot). [nd]. 30p. (In French). (CONF-740120-3). Dep. NTIS (US Sales Only) $4.50.

From 11th international symposium on radioactive isotopes in clinical medicine and research; Bad Gastein, Austria (8 Jan 1974).

8045 (CNAEM-R-128) APPLICATION OF EXOGENOUS PLANT GROWTH SUBSTANCES AND EXTRACTION OF THE NATURALLY OCCURRING CYTOKININS. Koeksal, G. (Cekmece Nuclear Research and Training Center, Istanbul (Turkey)). 1974. 37p. Dep. NTIS (US Sales Only) $5.00.

8046 (COO-1300-36) ORGANIZATION OF THE R CHROMOSOME REGION IN MAIZE. Triennial Report. Jan 1973. Contract AT(11-1)-1300. 12p. Dep. NTIS $4.00.

Much of the tissue specific variation in anthocyanin formation observed in maize is governed by a narrowly restricted segment of chromosome 10, designated the R region. Given alleles of R may be viewed as representing particular combination of several distinct properties. Principal objectives of the present study have

been to characterize these properties more fully, to identify the corresponding genetic determiners, and to work out their linear arrangement and functional relationships. (auth)

8047 (COO-2121-24) CYTOGENETICS OF MONOSOMES IN ZEA MAYS. Progress Report, October 1, 1973–December 31, 1974. Weber, D. F. (Illinois State Univ., Normal (USA)). 1974. Contract AT(11-1)-2121. 37p. Dep. NTIS $5.00.

Monosomics lack a pairing partner in each meiotic cell and genes on an entire chromosome are present in the hemizygous condition. Monosomics were isolated for chromosomes 1, 2, 3, 4, 6, 7, 8, 9, and 10 of Zea mays utilizing a recently-discovered system. The monosomic plants are surprisingly vigorous, good cytological samples can be taken, and crosses made. (CH)

8048 (COO-2164-8) ENERGY EXCHANGE WITHIN ECOSYSTEMS. Third Annual Technical Progress Report, September 1, 1973–August 31, 1974. Gates, D. M. (Michigan Univ., Ann Arbor (USA)). 17 Sep 1974. Contract AT(11-1)-2164. 12p. Dep. NTIS $4.00.

Results are summarized for a research program on the time-dependent thermal energy budget of animals. A lumped-parameter model for the time-dependent thermal energy budget of an animal was developed. Instrumentation to measure the operative environmental temperature of the environment for various animals and a combination wind tunnel-metabolism chamber for controlled studies of respiratory gas exchange under various combinations of environmental conditions were developed. (CH)

8049 (COO-2427-2) IDENTIFICATION OF PATTERNS IN DIAGNOSTIC ATTRIBUTES IN SKULL TRAUMA. Schonbein, W. R. 1973. 35p. Dep. NTIS $4.75.

8050 (COO-3140-30) ANNOTATED BIBLIOGRAPHY OF MEASUREMENTS OF SERUM COPPER IN MALIGNANT DISEASES. Sunderman, F. W. Jr. (Connecticut Univ., Farmington (USA). School of Medicine). 1973. 7p. (CONF-731152-1). Dep. NTIS $4.00.

From applied seminar on the laboratory diagnosis of cancer; Washington, District of Columbia, USA (2 Nov 1973).

8051 (COO-3243-3, pp 247-257) HYPERTHERMIA: ITS EFFECT ON PROLIFERATIVE AND PLATEAU-PHASE CELL CULTURES. Shulman, N.; Hall, E. J. 1 Jul 1974.

In annual report on research project.

8052 (COO-3243-3, pp 266-274) SUPPRESSION OF DNA SYNTHESIS BY GLUCOCORTICOIDS ON HEPATOMA CELLS IN VITRO. Borek, C. 1 Jul 1974.

In annual report on research project.

8053 (COO-3278-22) LIMITATIONS OF THE IN VIVO CHLOROPHYLL A FLUORESCENCE TECHNIQUE. Loftus, M. E.; Seliger, H. H. (Johns Hopkins Univ., Baltimore, Md. (USA)). 1974. 50p. Dep. NTIS $5.50.

The in vivo chlorophyll a fluorescence technique for phytoplankton depends on the effective absorption and fluorescence quantum yield of chlorophyll a. The range of variation in the ratio of in vivo fluorescence: extractable chlorophyll a was found to be nearly 10-fold in natural Chesapeake Bay phytoplankton populations with significant areal and seasonal differences in addition to ambient light dependent fluorescence inhibition. Diel variation in chlorophyll a fluorescence were found to be species specific responses of some diatom and dinoflagellate populations. Observed changes in fluorescence of several natural populations from day to night levels were as great as 8-fold when diatoms Cerataulina bergonii and Rhizosolenia sp. dominated the phytoplankton biomass. The diel response was associated with plastid migration and contraction. More rapid transients in fluoresence intensity with changes in ambient light, the Kautsky Induction Effect, were associated with the degree of nutritional stress in natural samples and unialgal cultures of phytoplankton. These observations may serve to explain some of the variations encountered in the application of the in vivo chlorophyll a fluorescence technique and provide a basis for a real time assessment of the physiological condition of natural phytoplankton populations. Differences in cellular in vivo fluorescence in vertical profiles of natural populations which might have been associated with species composition variation with depth were eliminated by uniform dark treatment and suggest the observed in vivo chlorophyll a fluorescence is related to in situ light color quality adaptation. (auth)

8054 (LA-tr-73-56) COMPILATION OF A DIGITAL BODY MODEL BY AUTOMATIC PROCESSING. Murai, S.; Kurihara, K. Translated from Ningen Kogaku; 8: No. 3, 121-127(1972). 15p. Dep. NTIS $4.00.

To obtain an accurate grasp of the complex configurations of the supple, elastic human body is an indispensable task for solving numerous problems in human engineering, such as the composition of clothing. Methods were developed for measurements of the human body by photogrammetry and the automatic processing of the body measurement data by computers. (CH)

8055 (LA-tr-74-29) ROLE OF NITROGEN IN MINERAL FERTILIZER IN MAIZE GROWTH, STUDIED WITH THE AID OF LABELLED ^{15}N. Latkovich, I.; Mate, F.; Varga, D. (CONF-670852-3). 1967. Translation of SM-97/35. 12p. Dep. NTIS $4.00.

8056 (ORO-3329-10) PROGRESS REPORT ON REGULATORY MECHANISMS OF EOSINOPOIESIS. (Duke Univ., Durham, N. C. (USA)). [nd]. Contract AT(40-1)-3329. 6p. Dep. NTIS $4.00.

8057 (ORO-4157-8) ERYTHROPOIETIC ACTIVITY IN RENAL HOMOGENATES. Waggoner, W. G. Jr. (North Carolina Univ., Chapel Hill (USA)). 1974. Contract AT(40-1)-4157. 70p. Dep. NTIS $6.75.

Thesis.

The effects of castration on erythropoiesis in the polycythemic male mouse was investigated. The sensitivity of the castrated mouse for use in the bioassay of erythropoietin was examined. The light mitochondrial fraction of hypoxic rat kidney known to contain the renal erythropoietic factor (REF) was tested in a number of experimental designs and the resulting degree of erythropoietic stimulation compared among the groups. (auth)

8058 (SGAE-2307) SCANNING ELECTRON MICROSCOPY OF BIOLOGICAL MATERIAL USING THE LUMINESCENT MODE. Hoerl, E. M.; Herbst, R.; Multier-Lajous, A. M. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Metallurgie). Jul 1974. 9p. (ME-59/74). Dep. NTIS (US Sales Only) $4.00.

It is shown that additional information to the information contained in the secondary electron image can be obtained for biological specimens by using the luminescent mode. In particular, the usefulness of fluorescent dyes for enhancing cathodoluminescence in special parts of cells or tissues is investigated. It is found that fluorescent dyes which are used in fluorescence microscopy are also usable in scanning electron microscopy. In the luminescent mode they cause contrasts different from the contrasts obtainable with the fluorescence microscope. (auth)

8059 (SGAE-2325) BIOCHEMICAL INVESTIGATIONS OF THE EFFECT OF NaF ON MAMMALIAN CELLS. I. Influence on Biosynthesis of Nucleic Acids and Proteins in Mouse Spleen Cells "in vitro". Klein, W.; Kocsis, F.; Altmann, H. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Inst. fuer Biologie). Aug 1974. 17p. (In German). (BL-103/74). Dep. NTIS (US Sales Only) $4.00.

The influence of fluoride ions on semiconservative DNA synthesis, DNA repair, and connected reactions was studied in vitro in mouse spleen cells. Even fluoride concentrations as small as 0,4 μg/ml show a distinct effect on excision-repair and partly on the phosphorylation of DNA precursors. An amount of 1,0/μg fluoride/ml causes a significant suppression of DNA-, RNA-, and Protein biosynthesis and alterations of the monokinase step of nucleotide phosphorylation. The possible mechanism of action of Na-fluoride is discussed based on these results. (tr-auth)

8060 (SLA-74-5337) ORGANIC HYDROGEN GETTERS. Courtney, R. L.; Harrah, L. A.; Anderson, D. R. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 14p. (CONF-740227-1). Dep. NTIS $4.00.

Development of an unsaturated organic–catalyst combination that is capable of reacting with molecular hydrogen to produce an inert saturated organic compound is reported. (LK)

8061 (TID-26652) PHYSIOPATHOLOGY OF BLOOD PLATELETS AND DEVELOPMENT OF PLATELET SUBSTITUTES. Progress Report, August 1, 1972–July 31, 1973. Baldini, M. G. (Brown Univ., Providence, R. I. (USA)). 1973. Contract AT(11-1)-3234. 32p. Dep. NTIS $4.75.

8062 (UCRL-51645) PHYSICAL, CHEMICAL, AND IN VIVO STUDIES OF THE NATURALLY OCCURRING DISSOLVED YELLOW ORGANIC SUBSTANCES OF FRESHWATER. Milanovich, F. P. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 29 Aug 1974. Contract W-7405-Eng-48. 109p. Dep. NTIS $8.50.

Thesis.

The yellow organic matter (yellow substance) of natural water was physically and chemically characterized. The source of water emphasized was the upper Russian River, California. Through gel filtration, the material was divided into three major yellow fractions and characterizations of the fractions was accomplished to include molecular weight determinations. The significance of the extinction coefficient ratio K_{420}/K_{665} as a means of describing yel-

low substance apart from humic acids was established. Elemental analysis indicated the material contained no nitrogen or phosphorus. The determination of the metal content by atomic absorption spectroscopy indicated the presence of elevated levels of several transition metals and lead. In vivo studies with the bacteria Escherichia coli were performed. Trace quantities of yellow substance failed to enhance the growth of cultures of E. coli and, when used as the sole carbon source, yellow substance supported no growth in the cultures. In cultures made toxic with copper, however, yellow substance was shown to detoxify the media. Comparison studies indicated that yellow substance was almost as efficient as EDTA and much more efficient than sodium citrate in reducing the copper availability to the growing bacteria. This demonstrates the possibility of a significant biological role for yellow substance as a prime metal moderator in aquatic ecosystems. (auth)

8063 (UCRL-TRANS-10712) STRUCTURE OF NORMAL AND PATHOLOGICAL LIPOPROTEINS. Picard, J.; Veissiere, D.; Ayrault-Jarrier, M. Translated from Ann. Biol. Clin. (Paris); 31: No. 2, 77-86(1973). 25p. Dep. NTIS $4.25.

The recent work on lipoproteins has made possible considerable progress in our knowledge of the structure of these macromolecules, their variations of form, the role of the lipids in their conformation, and the constitution of apolipoproteins in multiple subunits. Some studies provide closer information concerning the affinity of apopeptides for the various lipid constituents and the nature of associations between the lipid and protein constituents of these macromolecules. The relationships between the structure of lipoproteins and their enzyme activity are also better known. However, several problems still remain to be explained. The heterogeneity of lipoprotein classes and the discovery of abnormal lipoproteins raise the problem of the mechanism of association of the subunits and that of the relation between apopeptides and macromolecular structures. Many immunological problems on the specificity of antigenic sites and their masking by lipids remain open; above all, the mechanisms by which different organs respond to the mobilization of certain lipid categories by the construction of complex and nevertheless determined macromolecular structures are far from being resolved. Despite these gaps, the progress achieved constitutes an incontestable stimulus to further research. (auth)

8064 (UR-3490-595) ENERGY COUPLING TO Na^+- DEPENDENT TRANSPORT SYSTEMS: EVIDENCE FOR AN ENERGY INPUT IN ADDITION TO TRANSMEMBRANE ION GRADIENTS. Kimmich, G. A.; Randles, J. (Rochester Univ., N. Y. (USA). Dept. of Radiation Biology and Biophysics). 1974. 23p. (CONF-740808-2). Dep. NTIS $4.25.

From meeting of Federation of European Biochemical Societies; Budapest, Hungary (25 Aug 1974).

A considerable controversy has developed over the past several years concerning the nature of energy coupling events serving in support of Na^+-dependent transport systems for various amino acids and monosaccharide sugars. An important aspect of this controversy relates to whether the Na^+-dependent systems are entirely coupled to transmembrane gradients of monovalent ions, or are to a degree coupled to a second energy source acting in conjunction with the ion gradients. The latter possibility might represent direct coupling to cellular metabolic activity in the sense that ATP expenditure is required for energization of specific transport components; or a more indirect relationship might be involved in which ATP is necessary, but in a role not involving immediate interaction between the nucleotide and elements of the entry system for the organic solutes. (auth)

8065 (US-IBP-74-1(Vol. 4, No. 1)) ABSTRACTS: US-INTERNATIONAL BIOLOGICAL PROGRAM. Ecosystem Analysis Studies, Volume IV, No. 1. Kemp, H. T. (ed.). (Oak Ridge National Lab., Tenn. (USA)). Nov 1974. Contract W-7405-eng-26. 60p. Dep. NTIS $6.00.

Abstracts is a communication link between researchers in biome programs of the environmental component of the U. S. International Biological Program, to the IBP researchers in other countries, and to the non-IBP scientific community. USIBP groups currently participating are the Coniferous Forest Biome, Desert Biome, Eastern Deciduous Forest Biome, Grasslands Biome, Island Ecosystem Program, and Upwelling Program. Abstracts of reports and data sets are prepared within each biome, edited, and forwarded to the Eastern Deciduous Forest Biome Information Center (EDFBIC) where the material is reviewed, further edited, and entered into computer files. (CH)

Materials

8066 (AED-CONF-74-328-011) INVESTIGATION OF DEFECT DIFFUSION IN OXYGEN IMPLANTED GaAs BY SCANNING ELECTRON MICROSCOPE. Favennec, P. N.; Boulet, J. P.; L'Haridon, H.; Rao, E. V. K. (Centre National de la Recherche Scientifique, 54 - Villers-les-Nancy (France). Centre de Cinetique Physique et Chimique). 1974. 7p. INIS.

From international conference on lattice defects in semiconductors; Freiburg im Breisgau, F. R. Germany (22 Jul 1974).

5 figs.; 2 tabs.; 15 refs. With abstract.

Investigation of oxygen ion implants GaAs layers is carried out with the help of SEM and capacitance measurements. SEM analysis in simultaneous mode display, emissive and luminescence, permitted us to estimate the thickness of the implant damaged layer. A comparative study of implanted layers by the above method and by capacitance measurements led us to the following conclusions: a part of nonradiative recombination centers, not participating in electrical compensation, is beyond implanted ion ranges. These centers show a tendency to diffuse into the bulk both during implantation and during anneal to temperatures of about 360°C. (auth)

8067 (AERE-R-7820) PHOTOCHEMICAL REACTIVITY OF VINYL CHLORIDE. Cox, R. A.; Eggleton, A. E. J.; Sandalls, F. J. (UKAEA Research Group, Harwell. Atomic Energy Research Establishment). Sep 1974. 16p. Dep. NTIS (US Sales Only) $4.00.

The reactivity of vinyl chloride in the photochemical smog system was measured by two methods. In the first its reactivity has been compared with that of ethylene, propylene, and trans-2-butene when irradiated in air with simulated sunlight in the presence of nitric oxide. In the second its rate of reaction with hydroxyl radicals has been measured using OH produced by photolysis of nitrous acid. Vinyl chloride is only moderately reactive being similar to or slightly less reactive than ethylene but more reactive than normal paraffins. (auth)

8068 (BDX-613-1212(Rev.)) MOLDING MINIATURE PLASTIC PARTS. Pope, D. P. (Bendix Corp., Kansas City, Mo. (USA)). Nov 1974. Contract AT(29-1)-613. 26p. Dep. NTIS $4.75.

Small mechanical parts, normally made by expensive machining, were produced using coffin molds in combination with injection and transfer molding processes and materials. Functional parts can now be molded satisfactorily: transfer molding produced fine pitch gears to AGMA Class 9 standards. A tumbling process for flash removal was also developed. (auth)

8069 (BNL-50417) CONCRETE-POLYMER MATERIALS FOR HIGHWAY APPLICATIONS. Progress Report No. 3. Kukacka, L. E.; Fontana, J.; Romano, A. J.; Steinberg, M.; Pike, R. G. (Brookhaven National Lab., Upton, N. Y. (USA)). Dec 1973. 132p. (FHWA-RD-74-17). Dep. NTIS $5.45.

Experimental work on the use of concrete-polymer composites for highway applications has progressed in three general areas: material properties of polymer-impregnated concrete, the repair of deteriorated and delaminated bridge decks, and the partial in-depth impregnation of new decks. (MCW)

8070 (CONF-741023-1) PREPARATION AND ANALYSIS OF AQUATIC-RELATED SAMPLES. Ferguson, N. M.; Lund, J. R.; Rickard, R. R.; Corbin, L. T. (Oak Ridge National Lab., Tenn. (USA)). 1974. 15p. Dep. NTIS $4.00.

From 7th materials research symposium; Gaithersburg, Maryland, USA (7 Oct 1974).

Efforts under way to quantify the resultant environmental impact on receiving waters and forest lands from urban and industrial complexes and from energy production are described. Sample preparation laboratories to fulfill certain needs are in existence. An example of a laboratory used for processing aquatic samples for the analyses of Hg, Se, Cd, Pb, and Zn and the procedure for processing aquatic insects are described. Representative homogenates are analyzed directly by neutron activation analysis, or they are dissolved and analyzed by other multi-element techniques such as atomic absorption spectrometry or isotope dilution spark-source mass spectrometry. Special mercury analyses are performed by the cold-vapor atomic absorption method. Accuracy and precision of the multi-element methods are enhanced with acquisition and reductions of data with minicomputers. (MCW)

8071 (COO-2407-1) GENERALIZATION OF INTERNAL CENTRIFUGAL ZONE GROWTH OF METAL-CERAMIC COMPOSITES. Progress Report, December 1, 1973-August 31, 1974. Sekerka, R. F. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). 1974. Contract AT(11-1)-2407. 10p. Dep. NTIS $4.00.

The objectives are (1) to develop a realistic model of Internal Centrifugal Zone Growth (ICZG) and (2) to utilize the predictive capacities of this model to improve present ICZG systems and to extend the use of the ICZG concept in general. Mathematical models of hypothetical (infinitely long) samples heated by long RF induction coils were developed; these models are believed to display several essential features of the ICZG process. Study of these models for constant material properties shows that a large

surface-to-center temperature difference, needed for ICZG, is favored by small values of the parameter k/Lh where k is the thermal conductivity of the sample, h is the surface heat transfer coefficient, and L is the smaller of the sample radius or the RF skin depth. Moreover, computer solutions for the temperature and electromagnetic fields in cases where electrical conductivity is initially low but a strongly increasing function of temperature have displayed an interesting and perhaps technologically important heating instability phenomenon. For low values of an impressed RF field, there is very little heating of such a sample; whereas, after a critical value of the RF field has been exceeded, the slightly heated sample interacts with the RF field in an unstable manner, resulting in much higher steady state temperatures. Apparatus to test these predictions is being assembled. (auth)

8072 (COO-2407-2) GENERALIZATION OF INTERNAL CENTRIFUGAL ZONE GROWTH OF METAL-CERAMIC COMPOSITES: ONE-DIMENSIONAL MODEL. Sekerka, R. F.; Hartzell, R. A. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). Aug 1974. Contract AT(11-1)-2407. 63p. Dep. NTIS $6.25.

The electric and temperature fields within inductively heated materials is calculated to study the crystal growth process called Internal Centrifugal Zone Growth (ICZG). A complicated two-dimensional problem is studied via a simple one-dimensional model that applies to infinitely long samples heated by infinitely long induction coils. Two one-dimensional models are presented. (MCW)

8073 (COO-3551-13) DILUTE RESISTIVITY OF H AND D. Impurities in Noble-Transition Metal Alloys. Brown, J. S.; Flanagan, T. B. (Vermont Univ., Burlington (USA)). 1973. 8p. Dep. NTIS $4.00.

The resistivity ratio R/R_0 of alloys of AgPd, CuPd, and various other binary alloys with the addition of H and D interstitial impurities was measured and given as a function of H or D concentration. This ratio shows certain anomalies for various concentrations x in Ag_xPd_{1-x} and Cu_xPd_{1-x} with the addition of H and D. Attempts were begun to calculate these anomalies based upon a CPA analysis of the electronic state densities of the binary alloy involved. The analysis, which is currently in progress, attempts to explain the observed anomalies in terms of the competition between the disorder scattering of mixed OPW-TBA conduction electrons from the disordered array of H atoms or D atoms and the reduction in d-state density of states at the Fermi level, and its consequent reduction in the resistivity due to s-d scattering. In addition an attempt is made to incorporate non-rigid band effects such as the development of a peak of s-p electron states below the Fermi level due to the hybridization of the H 1s states with the Pd, Ag, and Cu d-states, as recently proposed in photoemission studies and APW calculations by Eastman, Cashion, and Switendick (1971). (auth)

8074 (LA-UR-74-1556) CYCLONE SAMPLING OF FIBROUS GLASS AEROSOLS. Ettinger, H. J.; Ortiz, L. W. (Los Alamos Scientific Lab., N. Mex. (USA)). 1974. 21p. (CONF-740677-1). Dep. NTIS $4.25.

From NIOSH symposium on occupational exposure to fibrous glass; College Park, Maryland, USA (26 Jun 1974).

Studies evaluating the 10-mm nylon cyclone against various fibrous glass aerosols indicate that this sampler has distinct and reproducible aerodynamic cutoff characteristics directly related to the ACGIH respirable dust curve. The respirable mass fraction of each test aerosol expected to pass this cyclone was estimated by relating Anderson impactor sizing data for the fibrous test aerosol, assuming a log-normal size distribution, to the ACGIH respirable dust curve. Collection efficiency of the cyclone sampler was adjusted to coincide with the respirable mass penetrating the cyclone by operating the sampler at flow rates ranging from 0.8 to 2.4 l/m. These tests indicate that the 10-mm nylon cyclone may be practical as a field sampler for the size selective separation of materials, such as fibrous glass and asbestos, into respirable and non-respirable fractions. (auth)

8075 (LBL-1800) CRYSTALLOGRAPHY AND STRUCTURE OF DEFORMATION INDUCED EPSILON AND ALPHA MARTENSITE IN Fe-Ni-Cr SINGLE CRYSTALS. Stone, G. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 120p. Dep. NTIS $9.00.

Thesis.

A comprehensive study of the crystallography and structure of deformation induced ϵ and α martensite (from austenite) in a low stacking fault energy Fe-15wt%Ni-15wt%Cr alloy was completed. The martensite needle axis, magnitude of the shape change, and direction of the shape change were measured. Results were compared to the Acton-Bevis two shear phenomenological theory, using two slip shears. (MCW)

8076 (LBL-2750) CRACK PROPAGATION RATES IN Fe-Ni ALLOYS. Sirot, H. A. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Aug 1974. Contract W-7405-eng-48. 112p. Dep. NTIS $8.75.

Thesis.

Fatigue crack propagation rates of iron nickel cryogenic alloys with 4, 8, 12, and 16 wt % Ni were measured as a function of the stress intensity range ΔK at different temperatures. Room temperature tests showed that stage II crack propagation rates for cracks propagating faster than 0.2 μm/cycle are relatively insensitive to grain size, yield strength, or nickel content, and the rates were comparable to those found in a 5 Mo 0.3 C steel. An equiaxed alpha structure, obtained by a very slow cool, was found slightly less resistant to fatigue crack propagation than a structure containing martensite, which was obtained by an iced brine quench. This slight effect could be due to either the change in substructure or the residual stresses associated with the production of martensite. The 12 Ni 0.5 Ti alloy that was iced brine quenched showed the best crack propagation resistance. Crack growth rates at −77°C, −116°C, and −196°C were measured as the interspace between the striations seen on the fatigue fracture surface using a scanning electron microscope. (MCW)

8077 (LBL-2786) LATTICE DEFECTS IN SPINELS. Van der Biest, O. O. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jul 1974. Contract W-7405-eng-48. 80p. Dep. NTIS $7.00.

Thesis.

A theoretical and experimental study was made of some lattice defects in the spinel structure of $LiFe_5O_8$ single crystals using transmission electron microscopy. From geometric and energetic arguments it was shown that for a $\frac{1}{4}\langle 110\rangle$ cation fault, the plane perpendicular to the displacement vector will have the lowest surface energy in a stoichiometric spinel. The influence of non-stoichiometry on the orientation of the fault plane is discussed. Extended stacking faults were found in flux grown lithium ferrite spinel single crystals, using high voltage electron microscopy. As predicted, the faults lie on $\{110\}$ planes, and have a displacement vector of $\frac{1}{4}\langle 110\rangle$ which is always perpendicular to the fault plane. The faults form three-fold junctions but can also be terminated by a dislocation with Burgers vector $\vec{b} = \frac{1}{4}\langle 110\rangle$. At 750°C an order-disorder reaction takes place in lithium ferrite. The spacegroup symmetry is lowered from Fd3m (spinel structure) to $P4_132$ or $P4_332$. The ordered structure can exist in two enantiomorphous forms. Simple electron microscopy techniques are described that allow the detection of the presence of two enantiomorphous forms of a structure within an apparent single crystal. (MCW)

8078 (LBL-2789) ENHANCEMENT OF CRYOGENIC FRACTURE TOUGHNESS THROUGH MICROSTRUCTURAL CONTROL IN A FERRITIC Fe-12Ni-0.25Ti ALLOY SYSTEM. Jin, S. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Jun 1974. Contract W-7405-eng-48. 93p. Dep. NTIS $7.50.

Thesis.

A thermal cycling technique that allows the grain refinement of Fe-12Ni-0.25Ti alloy from 40 to 60 μm (ASTM #5-6) to 0.5 to 2 μm (ASTM #15-18) in four cycles was developed. The process consists of alternate annealing in γ range and $(\alpha + \gamma)$ range with intermediate air cooling. The transformation behavior, the change of microstructures and cryogenic mechanical properties on each cycling step are described. Due to the ultrafine grain size, the ductile-brittle transition temperature of this completely ferritic alloy was suppressed below 6°K even in the presence of a sharp crack. Simple and economic methods of Charpy impact testing and fracture toughness testing below 6°K were developed using the styrofoam-lucite box system. In fracture toughness testing at 77°K, the mode of fracture was altered from brittle quasi-cleavage to complete ductile rupture through the grain refining. Fracture toughness testing of grain refined alloy at 6°K revealed essentially ductile dimple rupture. Cryogenic mechanical properties of Fe-Ni-Ti alloys were compared with two other commercial cryogenic alloys. (auth)

8079 (LBL-3104) STRUCTURE AND MECHANICAL PROPERTIES OF LOWER BAINITE IN Fe/4Cr/0.4C ALLOY. Miller, R. W. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 59p. Dep. NTIS $6.00.

Thesis.

The structure and mechanical properties of lower bainite were investigated in an Fe/4Cr/0.4C alloy. An earlier study found that an Fe/4Cr/0.35C alloy had very favorable mechanical properties in the untempered martensite state; however, in Fe/4Cr/0.4C, the martensite structure was very brittle. It was hoped that a lower bainite structure of the Fe/4Cr/0.4C alloy would have greater toughness. Lower bainite was obtained by isothermally transforming austenite just above the M_s temperature. The cooling rate from the isothermal transformation temperature was varied

to investigate this effect on the mechanical properties of the nearly 100% bainite structure. Tempering experiments, following bainitic treatments, were also performed in an attempt to improve the toughness of the material. Strength and toughness properties were comparable with a 0.4C quenched and tempered plain steel. The properties of the nearly 100% bainite structure were unaffected by the cooling rate from the transformation temperature. The chromium appeared to have a strong stabilizing effect on the carbides as the bainitic alloy showed greater temper resistance. The small martensite regions present in the bainitic structure had a relatively higher carbon content than the bainite regions. The effect of the martensite regions on the mechanical properties was unclear. (auth)

8080 (LBL-3161) THERMODYNAMICS OF Fe–C–X ALLOYS. Plaza-Meyer, E. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 118p. Dep. NTIS $9.00.

Thesis.

A simple analytical model is presented to compute phase equilibria and thermodynamic properties of the ferrite (α) and austenite (γ) phases in Fe-C-X alloys. The parameters for the model are determined by least squares fit to experimental binary phase diagrams and thermodynamic data for binary and ternary phases. The model was used to compute at various temperatures, the compositions of the α and γ phases under conditions of equilibrium and paraequilibrium. The agreement with experimental information is excellent. (auth)

8081 (LBL-3162) HEAT CAPACITY OF BISMUTH AS A FUNCTION OF PRESSURE AND TEMPERATURE. Jurado, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Sep 1974. Contract W-7405-eng-48. 77p. Dep. NTIS $7.00.

Thesis.

The heat capacity of bismuth is measured as a function of pressure and temperature in the two high-pressure polymorphic phases of Bi III and Bi V. An isotherm at room temperature (30 to 90 Kbar) and two isobars at 52 and 95 Kbar (90 to 290°K) are obtained. In Bi III the pressure data show a 13% increase of C_p from 30 to 40 Kbar and a 12% decrease from 40 to 80 Kbar. A 15% increase of C_p in the III-V transition at 88 Kbar is in agreement with published results. The temperature data in both phases show a strong linear behavior up to room temperature. A rough upper limit of 150°K for the Debye temperature Θ of Bi III and of 200°K for Bi V can be established. A discussion of the results is given. (auth)

8082 (MHSMP-74-10D) HE FRICTION SENSITIVITY. Period Covered: January–March 1974. Van Velkinburgh, J. H. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex. (USA)). 1974. Contract DA-11-173-AMC-487(A). 7p. Dep. NTIS $4.00.

For California Univ., Livermore.

Several additional instrumented skid tests were done on two HMX/Vistanex formulations, RX-04-EI (98/2 HMX/Vistanex) and RX-04-EJ (99/1 HMX/Vistanex). An extensive series of instrumented skid tests was done on RX-04-EO (95/5 HMX/Estane 5702-F2) and RX-04-EN (95/5 HMX/Estane 5702) at a 14° impact angle. Several partial reactions were observed. Evaluation of skid sensitivity of two floor coverings manufactured by Armstrong was conducted. Results of the tests are discussed. (auth)

8083 (SGAE-2311) PRESSURE-INDUCED CHANGES IN THE MOSAIC STRUCTURE OF KBr AND RbI CRYSTALS MEASURED WITH 412-keV-γ-RAYS. Blaschko, O.; Ernst, G.; Schneider, J. R. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Physik-Inst.). Jul 1974. 16p. (PH-162/74). Dep. NTIS (US Sales Only) $4.00.

Changes in the mosaic distribution of KBr and RbI single crystals under pressure up to 3.4 kbar have been investigated with 412-keV-γ-rays. In the case of KBr only small distortions are observed. In the case of RbI larger pressure effects occur both in the shape of the mosaic distribution function and in the integrated reflecting power of the measured rocking curves. These effects may have some connection with the pressure-induced phase transition in alkali halides. (auth)

8084 (SLA-74-0264) ORGANIC HYDROGEN GETTERS. Part I. Introductory Report. Courtney, R. L.; Harrah, L. A.; Schoenfelder, C. W.; West, L. A. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1974. Contract AT(29-1)-789. 20p. Dep. NTIS $4.00.

A novel approach to the removal of hydrogen from closed systems is described. It involves the catalytic hydrogenation of high molecular weight acetylenic compounds, or polymers, using heterogeneous catalysis. The hydrogen is gettered via a surface chemical reaction with the acetylene compound, or polymer, coated onto a palladium catalyst. The feasibility of using stable, high molecular weight acetylenes in hydrogen getter formulations is demonstrated by the solution and neat liquid state hydrogenation of phenyl propargyl ether (PPE) and the solid state hydrogenation of dimerized phenyl propargyl ether (DPPE). (auth)

8085 (UCID-16070) PREPARATION OF DENSE TITANIUM HYDRIDE. Rothman, A. J.; Griffith, C. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Jun 1972. Contract W-7405-eng-48. 21p. Dep. NTIS $4.25.

High density pieces of titanium hydride $\frac{1}{8}$ and $\frac{1}{4}$ in. thick were prepared by direct hydriding of solid titanium discs. The process consists of adding hydrogen at 750 to 850°C to saturation, then cooling and hydriding slowly under closely controlled conditions. A composition $TiH_{1.95}$ was obtained having a porosity 0.2 to 1%. Although many specimens had small microscopic cracks, those prepared from titanium containing 0.3% carbon were mostly crack-free. The process was not optimized, and it is believed that even thicker samples free of cracks could be obtained by more attention to the thermomechanical treatment of the titanium and by more detailed study of the hydriding cycle. (auth)

8086 (UCID-16135) TECHNIQUES FOR STUDIES OF LOW-STRESS DYNAMIC MECHANICAL BEHAVIOR OF MATERIALS. Results for Polystyrene, Polystyrene Bead Foam, and an Idealized Foam-like Material. Wasley, R. J.; Hawk, L. R.; Nidick, E. J. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Nov 1972. Contract W-7405-eng-48. 25p. Dep. NTIS $4.25.

The shock response of polystyrene, polystyrene bead foam, and a highly idealized polystyrene foam were tested using light gas guns. The purpose of these tests was to develop methods and instrumentation that would record results from very low pressure experiments under conditions of dynamic uniaxial-strain loading. Hugoniot data obtained using a modified quartz transducer show good agreement with that found using both a conventional quartz transducer and a manganin gage. The modified quartz transducer was applied to a preliminary study of the highly-idealized foam in order to approach the understanding of the dynamic behavior of foam on the basis of controlled microstructure. (auth)

8087 (UCID-16138) CHEMICAL ANALYSES OF CELLULAR SILICONE MATERIALS. Aspey, A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Oct 1972. Contract W-7405-eng-48. 18p. Dep. NTIS $4.00.

Comprehensive chemical analyses on 22 batches of cellular silicone (14 as raw material and finished parts and eight at intermediate stages of processing) were performed. The results are consistent enough to form the basis for a chemical specification, if needed. The occasional deposition of hard-water ions such as Ca and Mg is the only significant change resulting from the processing operations. The retention of 0.2 wt% chlorine in the product was unexpected, but the chloride ion was present to the extent of only 25 ppm. Although active peroxide content varied considerably and averaged only 70% of the theoretical amount, the recipe includes a sizable excess and the consistently low extractables content of finished parts indicated adequate cure of all batches. (auth)

8088 (UCID-16141) NOTES ON FLUORINE HANDLING AND FLUORONITROCARBON TECHNOLOGY. Snoeberger, D. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Oct 1972. Contract W-7405-eng-48. 29p. Dep. NTIS $4.50.

A description of the procedures for fluorine handling and preparation of fluoronitrocarbon compounds in the development of high explosives is given. Guidance is provided for design and operation of pilot-plant-scale equipment for preparation of fluoronitrocarbon compounds. FEFO processing at Aerojet using A-diol and the preparation of FTM and FDNE from NF at Rocketdyne are described. (MCW)

8089 (UCID-16173) PASTE-EXTRUDABLE EXPLOSIVES (PEX): INTERIM DEVELOPMENT REPORT I. Cramer, J. P.; Elson, R. E.; Fyfe, R. R.; Quong, R.; Scribner, K. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Dec 1972. Contract W-7405-eng-48. 76p. Dep. NTIS $7.00.

The development of a paste-extrudable explosive (PEX) to be used in nuclear devices is described. The problems of suitable liquid carriers, explosive performance, rheological behavior of pastes, processing, stability, and sensitivity to mechanical stimuli are analyzed. (auth)

8090 (UCID-16204) INVESTIGATION OF THE PRODUCTION AND FABRICATION BEHAVIOR OF LX-09. Holder, B. E.; Scribner, K. J.; Kowalski, B. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 13 Feb 1973. Contract W-7405-eng-48. 24p. Dep. NTIS $4.25.

The possibility was examined of there being a relationship between the apparent chemical composition of the plastic-bonded explosive formulation LX-09 and the high rejection rate of pro-

duction parts machined from this material. Six variables representing chemical qualification data for each of 190 batches from 10 lots of LX-09 were correlated to good-bad rejection rates by computer-aided pattern recognition methods. A study of anomalous loss patterns then revealed that the chemical composition of the bad lots was actually deficient in one of the binder components. (auth)

8091 (UCRL-13480) DATA ANALYSIS OF THE REACTION BEHAVIOR OF EXPLOSIVE MATERIALS SUBJECTED TO SUSAN TEST IMPACTS. Weston, A. M.; Green, L. G. (Brobeck (William M.) and Associates, Berkeley, Calif. (USA)). Jul 1970. Contract 8472107. 125p. Dep. NTIS $9.25.

For Univ. of California, Livermore.

The experimental behavior of the AEC Susan Test MOD-1 projectile impact tests is organized and described. Threshold ignition velocities and the timing of observed explosive reactions are related to the deformation and fracture behavior of the aluminum case containing the explosive material. Explosive magnitude values (Relative Energy Release) estimated from peak pressure readings numerically are related to values estimated from transit time indications. The computer codes used in performing the study are listed and described. (auth)

8092 (UCRL-51642) MECHANICAL BEHAVIOR OF DRY WESTERLY GRANITE AT HIGH PRESSURE. Heard, H. C.; Abey, A. E.; Bonner, B. P.; Schock, R. N. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Sep 1974. Contract W-7405-eng-48. 17p. Dep. NTIS $4.00.

Pressure-volume, uniaxial stress loading to failure, uniaxial strain, and ultrasonic velocity determinations were made on dry Westerly granite at confining pressures (σ_3) up to 4.0 GPa. The bulk modulus (K) increases smoothly from 22 GPa at atmospheric pressure to about 70 GPa at 4.0 GPa σ_3. Maximum volume compression is 0.07 at the highest pressure; the unloading closely follows the loading path. An effective K of 22 GPa and a shear modulus (μ) of 18 GPa is obtained initially on uniaxial stress loading at 0.5 MPa σ_3. As microcracks close at slightly higher pressure (20 MPa), the effective K increases to 35 GPa and μ to 24 GPa. Dilatancy occurs at shear stresses greater than about one-half the failure stress. Ultimate shear strengths at failure (brittle fracture) range from about 0.1 GPa at atmospheric pressure to 1.0 GPa at 0.7- GPa σ_3. Deformation in uniaxial strain to 0.6- GPa σ_3 indicates this granite loads along a shear stress-σ_3 trajectory of about one-half to two-thirds of the failure stress and diverges from the failure envelope with increasing σ_3. This uniaxial strain loading path lies only slightly above the pressure-volume curve. Values for K and μ calculated from dynamic measurements (1 MHz) at atmospheric pressure are 24% higher than those calculated from static determinations; at 0.4-GPa pressure, K and μ are 11% higher. (auth)

Physics and Engineering

8093 (AEC-tr-7597) METHODS FOR THE PREVENTION OR REDUCTION OF CRUST FORMATION. Junghahn, L. Translated by E. G. Silver from Chem.-Ing.-Tech.; 36: No. 1, 60-67 (1964). 21p. Dep. NTIS $4.25.

Crust (or scale) formation on the surfaces of apparatus impairs heat transfer and increases the pressure losses. Hence it is necessary to inhibit the formation of such deposits. Methods for the reduction or prevention of scale and crust formation will be described by examples from various branches of industry. Each type of encrustation exhibits characteristic properties. Thus it is necessary to test several of the processes discussed here for any given application so as to be able to choose the most favorable method. (auth)

8094 (AECL-4910) NEUTRON SCATTERING DATA FOR LIQUID NEON. Buyers, W. J. L.; Sears, V. F.; Lonngi, P. A.; Lonngi, D. A. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Aug 1974. 45p. Dep. NTIS (US Sales Only) $5.25. AECL $1.50.

The coherent neutron inelastic scattering in liquid neon was measured with a triple axis spectrometer. The van Hove scattering function, $S(Q, \nu)$, was determined for the range $0.84\text{Å}^{-1} \leq Q \leq 12.5\text{Å}^{-1}$. A compilation is presented of the results obtained for $S(Q,\nu)$ after corrections have been applied to the original data for background and multiple scattering. The compilation provides a convenient source of reference data for the dynamics of liquid neon. (auth)

8095 (BNWL-B-271) PULSETRONIC ELECTRODELESS CONDUCTIVITY INSTRUMENT REFERENCE MANUAL. Koski, O. H. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Jan 1974. Contract AT(45-1)-2130. 41p. Dep. NTIS $5.25.

Over the past ten years electrolytic conductivity work in support of plant application has been pursued with the evaluation and testing of several commercially available conductivity systems. The systems were generally workable, but involved risks with respect to long-term integrity of various components of the system such as seals, temperature compensation components and materials of construction. The development work was therefore directed toward the design of an electrodeless conductivity system with specifications to include: a life of ten years, a radiation exposure to 10^{10} R gamma, pressures to 100 psi, temperatures to 50°C and exposure to 3M nitric acid. A novel electronic system was developed to provide instrumentation responsive to the requirements for high sensitivity and electronic stability, low maintenance despite changes in the exposed magnetic components with time, service at high temperature, and radiation exposure. Conventionally, stabilization of the magnetic components is accomplished at the expense of sensitivity and noise. A conventional oscillator with stable amplitude and frequency that drives the toroid which induces the current in the solution loop requires adjustment to compensate for anticipated changes in magnetic properties. This design concept also requires that if the resistive loop is to be interrogated by measuring current flow, then a constant voltage must drive the loop. Therefore, the rate of change of flux must be constant during the measuring period. The instrument designed in this program satisfies this criterion by open-loop operation through use of the (pulsetronic) system developed. It can be shown that the peak voltage induced in the solution loop is constant over a large range of solution loop resistances despite changes in temperature and magnetic properties. This is true for a switch time, t, of essentially zero. However, the peak at $t = \Pi/W$ has an attenuation factor of $\exp(-\frac{1}{2}\,\Pi\, R/WL)$ and therefore is affected by circuit values. (auth)

8096 (CEA-CONF-2616) TWO DIMENSIONAL ANALYSIS OF A LATERAL BIPOLAR TRANSISTOR. Borel, J.; Haj Said, F.; Merckel, G.; Saintot, P.; Vandorpe, D. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). 4 Dec 1973. 17p. (CONF-7309124-1). Dep. NTIS (US Sales Only) $4.00.

From European solid state device research conference; Munich, F. R. Germany (18 Sep 1973).

The lateral structure of a bipolar transistor presents an important technological interest due to its simplicity of fabrication and the ease of making complementary devices. However the relatively small current gain is affected by the parasitic currents due to the surface recombination effect and bulk injection of the emitter-base diode. This latter limitation has been overcome using an N^+ substrate immediately below the emitter junction and the purpose of this paper is to propose a technological solution to minimize surface recombination effects. We make a theoretical two dimensional analysis of our particular device using the computer program MODMAG. Such an analysis has been previously done on the N^+ buried structure and provides a clear understanding of the physical behavior of the active device. Even detailed analytical investigations cannot be applied in our case due to the pure two dimensional effect. (auth)

8097 (CEA-CONF-2656) FERROELECTRIC X-RAY ANOMALOUS SCATTERING EFFECT APPLIED TO PROBING TRIDIMENSIONAL DOMAINS IN FERROELECTRICS. Peuzin, J. C.; Lissalde, F. C.; Bertaut, E. F. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). 23 Apr 1974. 15p. (CONF-740457-2). Dep. NTIS (US Sales Only) $4.00.

From conference on anomalous scattering; Madrid, Spain (22 Apr 1974).

A particular example of the application of ferroelectric anomalous scattering effect is reported. The following applications were studied: (a) Curie temperature determination in $YMnO_3$; (b) Dynamic study of appearance of three dimensional domain structures in ferroelectric crystal under fatigue conditions; and (c) Ferroelectric domain imaging via x-ray topography. The ferroelectric anomalous scattering effect thus appears to be a general tool for the study of ferroelectrics. The efficiency of this tool, however, depends largely on the disposal of sensitive and accurate means for measuring intensity differences. Methods were developed that allow relative intensity differences as low as 10^{-5} to be measured. Thus, the use of the ferroelectric anomalous scattering effect is possible even in the case of light element (for example in T.G.S. $I^+ - I^-/I = 4\%$ on the 0 2 0 peak obtained with the CuK_α radiation). (MCW)

8098 (CEA-R-4556) CONTRIBUTION TO THE STUDY OF THE MECHANISMS OF PHOSPHORUS DIFFUSION IN SILICON. Chambert, G. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Lab. d'Electronique et de Technologie de l'Informatique). Oct 1974. 84p. (In French). Dep. NTIS (US Sales Only) $7.50.

Thesis. Submitted to Universite Scientifique et Medicale, Grenoble (France).

A study is made of diffusion of phosphorus in silicon emphasizing profiles of concentration. Experimentally, diffusions are carried out, and the profiles of impurities and defects are characterized. The methods of characterization are respectively: the nuclear reaction for impurities and the electronic microscopy for defects. In a second part, the theoretical one, a numerical program, that can solve diffusion equations with variable coefficients, is used to simulate different theoretical models. Three types of theoretical models are considered: a model with generation of vacancies: a model based on the experimental results of microscopy: and a model with the diffusion of two species. The profiles obtained by the simulation are compared with the experimental ones. The last two models explain the kink that is characteristic of the P diffusion. These models are, for the moment, qualitative. (auth)

8099 (COO-1198-1100) NUCLEAR MAGNETIC RESONANCE IN SINGLE CRYSTALS OF THE DILUTE MAGNETIC ALLOYS: CuFe, CuCo, AND CuNi. Stakelon, T. S. (Illinois Univ., Urbana (USA)). Oct 1974. Contract AT(11-1)-1198. 181p. Dep. NTIS $12.25.

Thesis.

Nuclear resonances were observed from ^{63}Cu nuclei in the first few shells around Fe, Co, and Ni impurities in single crystals of their respective dilute alloys with copper. The resonances from these nuclei, called satellites, occur at fields shifted from the much more intense ^{63}Cu main resonance field when observed at a fixed frequency. Satellites were observed previously in these alloys in powdered samples only. These satellite resonances yield information about the electronic structure of the magnetic impurity. Heretofore, there has been no detailed analysis since the identification of which satellite arises from which shell of neighboring nuclei was not possible. Field shifts of most observed satellites were sensitive to the orientation of the static magnetic field with respect to the crystal axes. From a study of single crystal rotation patterns, identification was possible of the crystal symmetry of the shells from which the satellites originate as well as measurement of the strength of the interactions responsible for the anisotropic field shifts. (MCW)

8100 (COO-1569-120) NOVEL RESISTANCE BRIDGE FOR MEASUREMENT OF TEMPERATURE IN THE VICINITY OF 1°K. McLinn, J. A. (Minnesota Univ., Minneapolis (USA)). Nov 1974. 56p. Dep. NTIS $6.00.

The design, operation, and performance of an ac resistance bridge for low temperature measurements are described. The attainable temperature resolution appears to be about 10μ°K with a 10μ°K reproducibility. The ultimate limitations of the bridge seem to be the noise in the components and the reproducibility of the thermometer. (WHK)

8101 (COO-3153-122) INVESTIGATION OF TECHNIQUES WITH WHICH TO PERFORM CAPACITANCE MEASUREMENTS AT ULTRAHIGH PRESSURES. Alworth, R. L. (Cornell Univ., Ithaca, N. Y. (USA)). Aug 1974. 61p. Dep. NTIS $6.25.

Thesis.

An investigation of techniques to perform capacitance measurements at ultra-high pressures was based on the expectation that first order phase transitions in dielectric materials will be detectable due to a discontinuity in the dielectric constant at the transition. This discontinuity will then be reflected in the capacitance measured. The guiding design criterion entailed attaining the highest possible pressures while measuring only the capacitance of the sample. The basic apparatus employed was a modified Drickamer ultra-high pressure resistance cell. (MCW)

8102 (DESY-SR-72/5) SOFT X-RAY ABSORPTION IN CU–NI ALLOYS. Gudat, W.; Kunz, C. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Apr 1972. 8p.

Cu-Ni alloy films were investigated in the vicinity of the onset of 3p electron absorption in the photon energy range 50 to 90 eV. The spectra obtained can be described as a stoichiometric superposition of the individual Cu and Ni metal spectra. Any rearrangement of the states due to an alloy interaction is of no great influence. The result is in general agreement with results on soft x-ray emission, uv, and x-ray photoelectric emission. It contradicts the rigid band model and supports more recent alloy theories such as the coherent-potential approximation. The result supports the interpretation of the wide structures in the transition metal spectra as a predominantly atomic effect. (GE)

8103 (DESY-SR-73/1) PHOTOEMISSION FROM THE VALENCE BANDS OF SOLID RARE GASES. Schwentner, N.; Skibowski, M.; Steinmann, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Jan 1973. 9p.

The photoelectric yield of thin films of solid Ar, Kr, and Xe were studied between 10 and 32 eV using synchrotron radiation. The exciton series is associated with weak photoemission caused by decay of excitons. Above the band gap an intensive broad maximum followed by a distinct minimum is observed. Only weak spectral structure is superimposed. The gross spectral features of the yield in this energy range can be interpreted in terms of electron-electron scattering. (GE)

8104 (DESY-SR-73/7) OPTICAL STUDIES OF MOLECULAR CRYSTALS IN THE VACUUM ULTRAVIOLET USING SYNCHROTRON RADIATION. Koch, E. E. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Sep 1973. 11p.

From chemical spectroscopy and photochemistry in the vacuum ultraviolet; Valmorin, Quebec (5 Aug 1973).

A discussion is given of experimental results of reflectance measurements in the excitonic spectral region for gaseous and solid Ne, Ar, Kr, Xe, N_2, O_2, CO_2, CH_4, C_2H_6, and anthracene. (GE)

8105 (DP-1365) ELECTRONIC LEVEL INDICATOR FOR THE REMOTE VERIFICATION OF WIND INSTRUMENT POSITION. Sand, R. J. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). Nov 1974. Contract AT (07-2)-1. 19p. Dep. NTIS $4.00.

A battery-powered, electronic level indicator was built to aid in mounting wind direction instruments at several elevations on a 365-meter TV tower. Two gravity-sensing transducers in each wind instrument are positioned to indicate their orientation with respect to two horizontal axes, thereby determining the variation of the vertical drive shaft from the zenith angle. Electrical signals from the transducers are transmitted through cables to a monitoring station on the ground. (auth)

8106 (KFKI-74-70) PHOTOELECTRIC PROPERTIES OF CHALCOGENIDE FILMS. Balog, J. (Kozponti Fizikai Kutato Intezet, Budapest (Hungary)). Sep 1974. 10p. (In Hungarian). Dep. NTIS (US Sales Only) $4.00.

The photoelectric properties of chalcogenide thin film semiconductors were investigated. Results obtained by measuring the voltage dependence of the photopotential are presented under the given geometric conditions, + 0.2 V photopotential was obtained for the investigated amorphous film. The photocurrent yield determined by light of 735 nm wavelength was 1.15×10^{-7} charge/photon. The semiconductors show maximums for wavelength of 515 and 710 nm wavelength of light. (tr-auth)

8107 (K-TRANS-74) EXPERIMENTAL INVESTIGATION OF THE INLET NOZZLES OF STATIONARY AXIAL TURBOMACHINERY. Dobzhik, S. A.; Kartavenko, V. M. 1965. Translation of pp 56-72 from Aerodinamika Lopatochnyky Mashin. 22p. Dep. NTIS $4.25.

The results of a systematic study of nozzles of helical type are presented. A diagram of the facility for the aerodynamic study of helix type is shown. The influence of the helical geometry parameters on the nozzle characteristics was investigated. Effect of the degree of initial compression of the orifice; effect of the distance between collector and helix; effect of the height of the inlet cross section of nozzle; and the effect of inclination of the helix wall are variations studied. It is concluded that a change in the parameters of the helix has little influence on the character of the velocity distribution along the radius as well as along the circumference. (MCW)

8108 (ORNL-TR-2857(DRAFT)) PROPOSED SAFETY MEASURES IN HEAT-TREATMENT PLANTS. Lallemant, A. Translated by Martha Gerrard from Trait. Therm.; 78: 78-86 (1973). 13p. Dep. NTIS $4.00.

Fifty safety measures to save life and health of hot-process workers and their working tools are recommended. Inquiries carried out at the Volvo plant at Koping that makes the gear boxes and differentials, and the Pugeot plant at Mulhouse that also makes gear boxes are analyzed. It is concluded that accidents due to toxic gases are situations responsible for death sometimes; accidents due to thermal treatment salts cause serious skin injuries; and accidents due to oils are the cause of fires and very detrimental to equipment. (MCW)

8109 (PTB-E-1) BASIC REACTIVE POWER AND DISTORTION POWER FOR STATIONARY FLOW OF VOLTAGE AND CURRENT. Fack, H. (Physikalisch-Technische Bundesanstalt, Berlin (F.R. Germany)). Jun 1974. 75p. (In German). Dep. NTIS (US Sales Only) $6.75.

Formulas are derived for the reactive power and the distortion power for the stationary flow of voltage and current. (JSR)

8110 (SAND-74-0047) EVALUATION OF CONDUCTIVE VIAS FOR HYBRID MICROCIRCUITS. Hampy, R. E.; Norwood, D. P. (Sandia Labs., Albuquerque, N. Mex. (USA)). Sep 1974. Contract AT(29-1)-789. 33p. Dep. NTIS $4.75.

New radar systems using hybrid microcircuits require low impedance paths from the frontside of a substrate to the backside or ground plane. Techniques and procedures were developed to provide conductive vias (or feed-through holes) through the sub-

strate for this purpose. The evaluation is reported of test substrates made using sputtered tantalum nitride resistor film on one side and vacuum evaporated Cr–Au for the metallization on both sides and in the holes. Photolithographic techniques were developed to provide protection of the gold in the holes during the etching procedures. Information is presented on measured via resistance, temperature cycling (-55 to 125°C), high temperature aging (150°C), current carrying capability, the effects of the tantalum etching on the gold as well as film morphology studies. The results indicate that the techniques and procedures used provide conductive vias that will meet the electrical and temperature requirements of the intended application. (auth)

8111 (SAND-74-0096) DESCRIPTION OF THE SANDIA VERSION OF THE NASA-AMES FLOW FIELD CODE: INPUT-OUTPUT AND STORAGE LOCATIONS. Eaton, R. R.; Larson, D. E. (Sandia Labs., Albuquerque, N.Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 38p. Dep. NTIS $5.00.

The original version of the NASA-Ames flow-field code has been extended to include a wider range of body geometries and to calculate drag coefficients. In addition, several variations of punched-card output can be obtained that are useful for restarting and for input to auxiliary plot programs and heat-transfer codes. The input-output of this revised code is discussed in detail. (auth)

8112 (SAND-74-0173) FACTORS EFFECTING THE FLEXURE RESISTANCE AND PEEL STRENGTH OF LEAD FRAME BONDS. Johnson, D. R.; Bonham, H. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). Oct 1974. Contract AT(29-1)-789. 25p. Dep. NTIS $4.25.

The flexure resistance and peel strength of 0.127 and 0.178 mm (5 and 7 mil) thick lead frames, which were thermocompression bonded to metallized ceramic substrates, were determined. Comparison was made on the basis of existing bonding thermodes with parameters varied to promote a range of bond zone deformations extending from 10% through 65%. The flexure resistance for both lead frame thicknesses decreased with increasing bond zone deformation. In peel the bond failures increased and heel failures decreased with decreasing bond zone deformation. Results indicate an overall 41% increase in cycles to flexural failure for the 0.178 mm leads compared to the 0.127 mm leads. A 60% increase in flexure resistance for Sandia bonds compared to a 4% increase in flexure resistance for Bendix bonds revealed that tool configuration is a critical parameter. A 29% increase in bond peel strength was determined for the 0.178 mm leads over the 0.127 mm leads. (auth)

8113 (SAND-74-0298) THIN-FILM RADIATIVE-PULSE CALORIMETER USING A DIFFERENTIALLY TRANSPARENT BARRIER. Schimmel, W. P. Jr.; Donaldson, A. B. (Sandia Labs., Albuquerque, N. Mex. (USA)). Nov 1974. Contract AT(29-1)-789. 15p. Dep. NTIS $4.00.

A two-wavelength model is applied to the analytical consideration of the radiant heat transfer occurring when a solid, which is covered by a differentially transparent barrier, is irradiated with a large pulse of visible energy. By "two-wavelength" and "differentially transparent," it is assumed that the barrier is esentially transparent in the visible portion of the spectrum but opaque in the infrared. The longer wavelength radiation emitted by virtue of the solids temperature is thus suppressed. Comparison is made with an unprotected sample to show that "optical tamping" is possible if the barrier is properly chosen. (auth)

8114 (SAND-74-5568) COMBINED CREEP AND PLASTICITY ANALYSIS OF METAL–CERAMIC STRUCTURES. Burchett, S. N.; Krieg, R. D.; Nickell, R. E. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1974. 9p. (CONF-741001-13). Dep. NTIS $4.00.

From CUBE symposium; Livermore, California, USA (23 Oct 1974).

A combination analytical/experimental program is underway to understand the crucial design parameters involved in the bonding of conducting metallic elements to insulating ceramic elements for electronic vacuum tubes. The essential mechanical features of a typical area seal have been reproduced in an experimental geometry that lends itself to accurate deformation measurements. An analysis that includes the combined effects of metallic creep and rate-independent plasticity is then carried out with a general purpose, nonlinear, finite element program in order to determine whether current computational algorithms are adequate to describe such complex physical behavior. The creep model chosen for the braze bond layer is composed of: (i) a uniaxial data fit to available information on copper; (ii) an associated flow rule for multiaxial states of stress and strain and (iii) a strain hardening rule, based on total creep strain, for time-varying stress states. Parameters in the uniaxial data fit are functions of temperature. The plasticity model treats the metal and braze materials as elastic-perfectly plastic with temperature-dependent yield functions. Results for a Kovar-alumina area seal indicate that the creep behavior of the braze can be exploited in order to minimize the residual stresses due to relative thermal expansion of the different materials. (auth)

8115 (UCID-16016) IMPLEMENTATION OF A DIRECT-DIGITAL MULTIPLE-ACTUATOR-SHAKER CONTROL SYSTEM. Fisher, D. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 6 Apr 1972. Contract W-7405-eng-48. 23p. Dep. NTIS $4.25.

A direct-digital control (DDC) system for LLL's multiple-actuator shaker is presently under development. The design objectives of the DDC system originated from an analysis of the performance capabilities and limitations of the existing analog control system. Both the hardware and software configuration of the DDC system were established. The general mathematical formulation of an ideal cross-coupling compensator was derived and is being applied to the control of swept-sinusoid vibration tests. (auth)

8116 (UCID-16043) THIN FILM THERMOPILE: TEST RESULTS. Ciarlo, D. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Apr 1972. 8p. Dep. NTIS $4.00.

The 400-junction thin film thermopile matrix consisting of copper-nickel thin film thermocouples with 0.07-mil gold absorbing buttons on the 200 hot junctions was tested. Its output was compared with the output from a discrete thermopile matrix made of 2-mil chromel-constantan wires and 5-mil gold absorbing buttons on the 25 hot junctions. A xenon flash tube was used as a source for the test. The power density of the xenon flash tube was not known, but the rise time, fall time, and magnitude of the voltages from the two types of thermopiles can be compared. The experimental setup and the results of the tests are described. (MCW)

8117 (UCID-16044) THIN FILM THERMOPILE MATRIX. Ciarlo, D. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 21 Mar 1972. 15p. Dep. NTIS $4.00.

An experiment was completed to determine the feasibility of using thin film circuit technology to make a thermopile matrix for measuring x-ray intensities. Several devices were vacuum evaporated. The EMF of copper-nickel and gold-nickel thin film junctions was measured. A 20-junction thin film thermopile matrix and a 400-junction thin film thermopile matrix were constructed. (MCW)

8118 (UCID-16046) SOMETHING YOU'VE ALWAYS WANTED TO KNOW ABOUT CONTROL PANELS (BUT WERE AFRAID TO ASK...) OR SAFE CONTROL PANELS FOR MECHANICAL EQUIPMENT. Ng, W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 31 May 1972. Contract W-7405-eng-48. 11p. Dep. NTIS $4.00.

California state law provides safe manufacturing and design criteria for electrical equipment control panels. Some equipment received at LLL fails to comply, causing safety hazards. Proper and improper designs are illustrated, together with ways of specifying safe control panels. (auth)

8119 (UCID-16068) FAIL-SAFE ISOLATION DEVICE PROVIDES MAXIMUM ENERGY TRANSFER FROM EXPLODING WIRE EXPERIMENTS. Zucker, O. S. F. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 15 Aug 1967. Contract W-7405-eng-48. 53p. Dep. NTIS $5.75.

The use of an isolation device (Iso-Box) as the interface between a detonator circuit and some external instrumentation is described. The device permits transfer of the desired signal from the detonator circuit to the outside, and prevents any signal of any accidental or deliberate waveform from the outside circuit damaging or setting off the detonators. The system has drawbacks and a new design is proposed that increases the reliability and improves energy transfer. The unintentional operation of the detonators is prevented by appropriate use of a high voltage fuse. The system will unilaterally transfer 80% of the detonator voltage into a 50 Ω cable. The reverse flow of energy is limited by a 30 kV fuse. (MCW)

8120 (UCID-16082) TENSILE FIELD CALCULATION ABOUT A PRESSURIZED CAVITY: MONERO. Norris, D. M. Jr. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 5 Jul 1972. 9p. Dep. NTIS $4.00.

A summary of the tensile stress field calculations in the vicinity of a cavity is treated as an elastic half space containing a spherical cavity. The loads are the formation body forces and cavity pressure. The stress in the vicinity of the cavity is the result of the overburden stress due to the one g load on the half space containing the cavity superposed on the stress field due to pressure inside the spherical cavity. The tensile stresses are similar to those generated in any spherical pressure vessel and are confined to re-

gions close to the cavity boundary. In a thick wall vessel with no body forces these tensile hoop stresses decay as the inverse cube of the radius. The calculations use a static axisymmetric finite element computer program. The stress state around the cavity is calculated with full overburden stress and ratios of cavity pressure to overburden stress of 1, 2, and 3 for Poisson's ratio of 0.1, 0.2, 0.3, and 0.4. (MCW)

8121 (UCID-16084) EVALUATION OF THE INTEGRITY OF A STRUCTURE USING AN ACOUSTIC-EMISSION-INSTRUMENTED PROOF TEST. Tatro, C. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Jul 1972. Contract W-7405-eng-48. 9p. Dep. NTIS $4.00.

An evaluation of a single-material structure that must survive a dynamic load superimposed on a large static load is presented. The use of acoustic emission detection equipment to detect flaws and flaw growth during proof testing is described and the correlation of proof-test results and structural behavior discussed. It is concluded that acoustic emission detection techniques can give higher assurance of structural integrity under specified conditions than can classical nondestructive testing methods alone. (auth)

8122 (UCID-16085) FLUID PRESSURE REQUIRED TO EMPLACE THE LOWER PLASTIC PLUGS ON THE FLAX EXPERIMENT. Pitts, J. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Jul 1972. Contract W-7405-eng-48. 15p. Dep. NTIS $4.00.

Permeability of Overton rock and Overton gravel were experimentally determined to be 158,000 and 13,600 Darcys respectively. Overton rock, dropped in a 327 ft long vertical drill pipe to simulate actual stemming operations, was found to have a permeability about equal to Overton gravel. The predicted pressure loss as the plastic material flows through the aggregate to form a plastic plug is about 30 psi if Overton rock is utilized as the aggregate and about 360 psi if Overton gravel or dropped Overton rock is used. A plastic material viscosity of 3000 centipoise was used in the calculation. Pressure loss, including gravitational effects, as the plastic flows down the 2.44 in. i.d. emplacement pipe was calculated to be 1400 psi for the plug at 1960 ft and 1500 psi for the plug at 2100 ft. (MCW)

8123 (UCID-16124) AC BRIDGE FOR EDDY CURRENT MEASUREMENTS. Taylor, G. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Oct 1972. Contract W-7405-eng-48. 25p. Dep. NTIS $4.25.

The analysis of an ac bridge circuit used for eddy current nondestructive testing relates input conditions and output indications in graphical and tabular form. A general procedure for obtaining and analyzing data in a development program is included, together with the conversion of instrument readings to engineering units. (auth)

8124 (UCID-16139) WRITING RATE TESTS OF FOUR SELECTED OSCILLOSCOPES. Summers, M. A. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 18 Sep 1972. Contract W-7405-eng-48. 10p. Dep. NTIS $4.00.

The purpose of these tests is to ascertain and compare the writing rate capabilities of several selected oscilloscopes being considered as replacements for the Tektronix 519 oscilloscope in B-Division's materials studies experiments. Test procedures and results are presented. (WHK)

8125 (UCID-16180) INFLUENCE OF VIBRATIONAL, ROTATIONAL, AND REORIENTATION RELAXATION ON PULSE AMPLIFICATION IN MOLECULAR AMPLIFIERS. Hopf, F. A.; Rhodes, C. K. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 14 Feb 1973. Contract W-7405-eng-48. 66p. Dep. NTIS $6.50.

Short pulse amplification in gaseous molecular amplifiers is complicated by many aspects of atomic and molecular interactions. Among these are the various vibrational, rotational, and reorientational relaxational processes which influence the coupling of the energy stored in the molecular radiators to the electromagnetic field. The properties of plane-wave pulse amplification, especially in the saturated regime, are examined numerically in order to quantitatively determine the detailed effects of these relaxational phenomena. Results for saturated amplification show that the amount of extracted energy decreases significantly when the rotational relaxation time is sufficiently long in comparison to the pulse width. The development was observed of pulse shape variations that are a direct result of the collisional phenomena and differ qualitatively from the results obtained for amplifying media without an energy reservoir. There is a tendency for the pulse lengths to increase due to the energy transfer in contrast to the strong narrowing effects that occur in the absence of the collisional processes. The influence of reorientational collisions is found to be small accounting for less than approximately a 20% effect on the overall conclusions. Results are presented concerning the development of an asymptotic pulse shape in high gain amplifiers. In this case, the pulse shape clearly exhibits the competition between the stimulated rate, which scales with the optical flux, and the collisional rates which are determined by the particle density. Calculations of this nature may be applied directly to CO_2, CO, and HF molecular amplifiers for both the electrically and chemically driven systems. (auth)

8126 (UCID-16205) MODEL FOR THE BLOOMING EFFECT IN AN INFRA-RED STREAK CAMERA TUBE. Kalibjian, R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Jan 1973. 39p. Dep. NTIS $5.00.

A model was proposed to explain the blooming effect reported in an infrared streak camera tube. The model basically considers the negative perturbation of the surface potential of the cathode due to the photovoltaic effect. A consideration of the perturbation of the equipotentials in the immediate region of the emitting portion of the cathode shows the existence of a time-varying microlens that can be diverging (converging) for a negative (positive) perturbation in the surface potential. In regards to the blooming model, the vacuum region adjacent to the photocathode is very critical in the control of the effective electron spot size at the cathode. Also the aberration in the main lens that images the effective cathode spot upon the phosphor screen is very important. (MCW)

8127 (UCID-16251) ALL-PASS TRANSFORMER NETWORKS. Buntenbach, R. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 17 Apr 1973. Contract W-7405-eng-48. 22p. Dep. NTIS $4.25.

Means for extending the frequency range of transformers by converting them into all-pass networks are described. (auth)

8128 (UCID-16613) APPROACHES TO HIGH TEMPERATURE ELECTRONICS. Blum, A. S. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 16 Oct 1974. Contract W-7405-eng-48. 8p. Dep. NTIS $4.00.

After preliminary investigation, three potentially viable approaches to the problem of constructing high temperature electronic systems (operable to 500°C) have emerged. The three approaches utilize: 1) miniaturized vacuum electronics, 2) III-V compound semiconductors, and 3) silicon carbide films. Aspects of the development programs for the three different approaches are examined. (WHK)

8129 (UCID-16622) HANDY GUIDE TO THE PRESHOT ANALYSIS FOR INTERFEROMETRIC MEASUREMENTS. Kamegai, M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 4 Apr 1974. Contract W-7405-eng-48. 13p. Dep. NTIS $4.00.

Two methods of preshot analysis for measurements that require a laser Doppler interferometer are described. Prior to the experiment, the velocity history to be measured is calculated using the best available data on the material. Then the calculated velocities are translated into an interferometric fringe pattern. Such an approach to interferometric measurements is very useful when an attempt is made to measure complex velocity profiles where the frequency of the signals to be recorded varies greatly during the measurement. In such an experiment, the frequency can often exceed the bandwidth of the photomultiplier. An analysis of the interferometric data avoids the risk of losing important data by properly adjusting the interferometer before the experiment. (auth)

8130 (UCID-51665) NEW DIE-CAST PROJECTILE DESIGN FOR TWO-STAGE LIGHT-GAS GUNS. Evans, L. B.; Hord, B. L.; Mitchell, A. C.; van Thiel, M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 2 Oct 1974. Contract W-7405-eng-48. 7p. Dep. NTIS $4.00.

A new high-strength die-cast projectile designed for the LLL two-stage light-gas gun is described. In addition to easy fabrication, the new design promotes flat impact between the planar surface of the accelerating projectile and a stationary target. Tilt and surface distortion, deviations that affect flat impact, are measured for the newly-designed projectile accelerated to 6.7 km/sec. Time variations due to surface distortion were less than ±3 nsec; those due to projectile tilt were within ±10 nsec, across a central 20-mm-diameter circle on the 24-mm-diameter impactor plate. (auth)

8131 (UCRL-51661) SINGLE-RIDGE WAVEGUIDE AND ITS COUPLING TO FABRY–PEROT RESONATORS: PART 1. Theoretical Description. Van Blaricum, M. L. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 23 Sep 1974. Contract W-7405-eng-48. 18p. Dep. NTIS $4.00.

The functional form of the fields in a single-ridge waveguide are presented. Bethe's small-hole diffraction theory is used to

determine the coefficient for coupling from various parts of the guide to a Fabry–Perot resonator. It is shown that frequency-independent coupling over a very broad band is possible, and specific examples are given for the band from 18.0 to 40.0 GHz. (auth)

8132 (UCRL-75766) S-1 PHOTOCATHODE RESPONSE LINEARITY AND DYNAMIC RANGE WITH PICOSECOND 1.06 μ LASER PULSES. Thomas, S. W.; Tripp, G. R.; Coleman, L. W. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 9 Sep 1974. 24p. (CONF-740952-1). Dep. NTIS $4.25.

From 6th symposium on photoelectronic image devices; London, UK (9 Sep 1974).

Lawrence Livermore Laboratory has developed a semiautomatic test set for making linearity measurements of ICTs (image converter tubes) and photodiodes. This test set, using a 36-ps laser pulse at 1.06 μm, has provided much-needed information on the operating characteristics of these components for picosecond research applications. These measurements have provided evidence that an ICT must have greater than 5 μa/W sensitivity to ensure its output-input linearity. Also, the photoelectric current range of a photodiode can be considerably greater than its linear limit when the unit is saturated. In this study, 44-mm photodiodes with a linear photoelectric current range limit of 60 A were found to produce from 200 to 600 A when saturated. Likewise, saturated 20- and 10-mm photodiodes produced currents three to seven times their normal linear limits (14 to 20 A for the 20-mm diodes and 7 A for the 10-mm diodes). Finally, all of these current limits are roughly proportional to diode bias. (auth)

8133 (UCRL-Trans-1518) COVALENCY OF THE ELEMENTAL STRUCTURES AND AB COMPOUNDS. I. Theorem of Leman, Thorpe, and Weaire. II. Moment Expansions. Friedel, J.; Lannoo, M. Translated by C. Krause from J. Phys. (Paris); 34: 115-121(1973). 72p. Dep. NTIS $6.75.

In the framework of the simple Hückel model for σ bonds, Leman, Thorpe, and Weaire's theorem on the existence of a forbidden energy gap is obtained directly and extended to structures with dangling bonds. The results are valid in other cases of covalent bonding, with one atomic orbital per bond. In Part II, the results of Thorpe and Weaire's theorem are compared to those of a moment development of the density of states, valid away from the crossing point between s and p bands. These two methods can also be combined. Rough estimates can be given in these ways of the energies of perfect and imperfect crystal structures and of amorphous structures. The extension of these results to other cases of covalent binding is discussed, and the validity of the simple model used. (auth)

8134 CZECHOSLOVAK-SOVIET COOPERATION IN NUCLEAR POWER. Neumann, J. (Ceskoslovenska Komise pro Atomovou Energii, Prague). Veda Tech. SSSR; 1: No. 1, 1-3 (Jun 1973). (In Czech.).

Czechoslovak-Soviet cooperation in the field of nuclear power has developed in three stages—from Soviet aid in establishing nuclear research in Czechoslovakia to the present stage of the integration of research, development and production in the field of nuclear power production and nuclear power engineering. (INIS)

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